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THE MEDICAL JOURNAL OF AUSTRALIA.

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INTRAVENOUS INJECTIONS IN THE TREATMENT OF HÆMORRHAGE AND SHOCK.[1]

By A. Holmes à Court, M.D. (Sydney), M.R.C.P. (London),
Honorary Assistant Physician, Sydney Hospital.

I.—Scope of the Investigation.

The treatment of traumatic hæmorrhage and shock may be said to have been revolutionized of recent years by the application of the transfusion of blood and the infusion of colloidal solutions.

The scope of this paper is to review the question of the use of intravenous injections in these conditions, to discuss some of the physiological and pathological problems involved and to form an estimation of the relative values of various fluids used for intravenous injections.

Direct observations are here recorded of a series of 60 cases treated by intravenous injections, consisting of:

(1) Patients suffering from severe traumatic hæmorrhage in which shock is a secondary factor.
(2) Patients suffering from acute shock resulting from wounds in which hæmorrhage may have occurred in greater or less amount as a complication.

Since many of the cases of the series recorded were treated in advanced dressing stations during the recent world war, it was frequently not possible to make minute mechanical measurements of blood pressure, etc.. These observations have been recorded as frequently as circumstances permitted and the results have been found to confirm the findings of other observers, notably Fraser and Cowell (1), working under more favourable conditions. On the other hand, although working under adverse circumstances, the writer was afforded an opportunity probably almost unique of making clinical observations on men suffering from traumatic hæmorrhage and shock within a very short time of the receipt of the injury.

II.—Pathology of Shock and Hæmorrhage.

Before entering upon the discussion of the means adopted for the treatment of shock and hæmorrhage, it is necessary to consider in detail the pathological bases of the morbid phenomena found in these conditions, as far as modern research in these subjects extends.

A.—Causation of the Phenomena of Shock.

The literature is so filled with hypotheses of the causation of shock that it is necessary to analyse the question with extreme caution.

During the period of the war (August, 1917), the Medical Research Committee, London, invited a special investigation committee to undertake the coordination of inquiries into surgical shock and allied conditions. Under the auspices of this committee much valuable work has been done in the investigation of certain points which have an intimate bearing on the subjects here reviewed.

Although the symptoms ascribed to wound shock are often intimately associated with the symptoms of hæmorrhage, it is nevertheless necessary for the purpose of this investigation to discriminate as far as possible between signs and symptoms due to loss of blood *per se* and those due directly to the condition known as shock.

Moreover, as the scope of this paper is concerned with the value of intravenous injections, it is necessary first to consider the recent advance in the knowledge of changes in the distribution and character of the blood in shock and in hæmorrhage.

Blood Changes in Shock.—Careful observations have been recorded by Cannon, Fraser and Hooper (2) in 98 cases of shock and hæmorrhage. These observers found that the first noteworthy feature of the blood in shock is a concentration of blood in the superficial capillaries. The capillary count was found to average six to eight millions per cubic millimetre. Even when the condition was complicated by hæmorrhage, the same phenomenon was noted. Counts of red cells from the larger veins give readings from one to two millions lower than the capillary count. In normal individuals not suffering from shock or hæmorrhage the difference between capillary and venous counts is given as from 1% to 3%—Burker (3). It is a matter of common experience that the surface temperature of animals suffering from shock is lowered. This might be due to diminished heat production, to disorder of the heat regulating mechanism, or to increased heat loss. The fact that fall of temperature is one of the earliest objective signs in shock suggests that the disorganization of the vasomotor system is the important causative factor. The lowered surface temperature of patients in shock is probably an important factor in augmenting the increased corpuscular content of the capillaries, the objective signs of which are the clammy extremities, not infrequently bluish-grey in colour from the cyanosis resulting from the stagnation of the blood. It is, moreover, well recognized that blood drawn from a cold finger contains a larger number of corpuscles in a given volume than that drawn from the same finger after it has been warmed—Gulland and Goodall (4).

The difference between the capillary and venous blood in cases of shock is further confirmed by hæmoglobin estimations, Cannon (2) and his coworkers finding that the capillary estimation exceeds the venous by from 6% to 29% hæmoglobin. Moreover, it is in the capillary region and in the finer arterioles that the corpuscles are most intimately related to the vessel wall and it is there that friction is greatest, so that the energy stored up in the arterial pressure is chiefly used up in this region. When the blood pressure is low and the circulatory mechanism failing mechanically, there is a natural tendency of the corpuscles to collect in the place of greatest resistance. The viscosity of the blood is, moreover, increased by cold, thus favouring capillary stasis.

[1] This article represents the author's thesis for the M.D. examination. Owing to the difficulty in finding sufficient space, many of the case records have been omitted.

The blood thus checked in capillary areas is therefore out of currency; by failure to return to the heart thus contributes to a lowering of arterial pressure. The loss of heat from the engorged capillaries must then be relatively great. Consequently a vicious circle is set up, capillary engorgement tending to produce loss of heat, the stagnation in the capillaries being in turn increased by cold. The supply of blood to the heart is therefore progressively decreased, so that in turn the efficiency of the heart as a pump diminishes, leading to still further stagnation.

It is of historical interest to note here that, before these investigations demonstrated that the blood in conditions of shock is dammed up in the capillary area, it was usually taught that one of the most marked phenomena was an engorgement of the splanchnic area. The clinical experience of surgeons opening the abdomen in cases of acute shock, frequently recorded during the war, has tended to render this hypothesis untenable. Animal experiments recorded by Mann (5) make it obvious that, were the blood stagnant in the splanchnic area, the dilatation of veins would be gross and readily observed. Cannon (6), in reviewing this matter, concludes that "methods employed to produce shock in lower animals, such as manipulation of the gut, which have repeatedly called attention to the abdomen and its circulation, have given rise to misleading inferences as to what occurs in natural shock produced by trauma to regions other than the belly."

Nerve Exhaustion Hypothesis of Shock.—It is not intended here to discuss the nerve exhaustion hypothesis of Crile or the numerous other suppositions which have been from time to time put forward to account for the failure of the circulation in shock. It is sufficient to note that, although Crile (7) and Mott (8) have demonstrated molecular changes in the central nervous system, subsequent to external injury or exhaustion and the former (Crile) has expressed his belief that the most vital effect of shock is the "impairment of the vasomotor mechanism," yet there are other competent observers, notably Porter (9) and his collaborators, who found that both pressor and depressor reflexes still occur in severely shocked animals; the vasomotor centre therefore still possesses tonic activity. The pressor responses show that the vasomotor centre is still capable of increased action when stimulated. Furthermore, Pike, Guthrie and Stewart (10) have shown that the vasomotor centre is more capable of withstanding the adverse influences of anæmia than any other of the vital bulbar centres. Bayliss (11), however, points out that these conclusions, being derived from animal experiments, may not be directly applicable to man and suggests that in man the vasomotor centre may be relatively more vulnerable. It is possible, therefore, that the changes in the nerve cells may be interpreted, in part, at any rate, as a result rather than the cause of the symptoms of circulatory failure in shock. All observers, however, agree that, if the vasomotor centre has become so irreparably injured as to be beyond recovery, no fluids transfused or infused can be of any avail; upon the condition of the vasomotor centre, therefore, the ultimate prognosis of shock must depend.

Moreover, it has been shown experimentally that the contraction of heart muscle is not primarily defective in shock. Cardiac contraction begins to weaken when the systolic pressure falls below 80 mm. Hg.—Markwald and Stewart (12). When, however, there is great increase of carbonic acid in the blood, the heart finally relaxes and comes to beat less energetically—Patterson (13). The lowered blood pressure and, finally, the accumulation of CO_2 in the blood thus in time come to impair the efficiency of the heart.

In the present state of our knowledge, therefore, it is advisable to endeavour to counteract the tangible evidence of disturbed circulation observable and to base our rational treatment upon the pathological indications actually observed, regarding the lowered arterial pressure and defective circulation, as directly due to the diminished volume of blood in active circulation at the time.

As to the primary cause of this exæmia, as it has been called, whether or not it be due to the effects of painful or other stimuli, by producing molecular changes in the nervous system, it is at present impossible to decide.

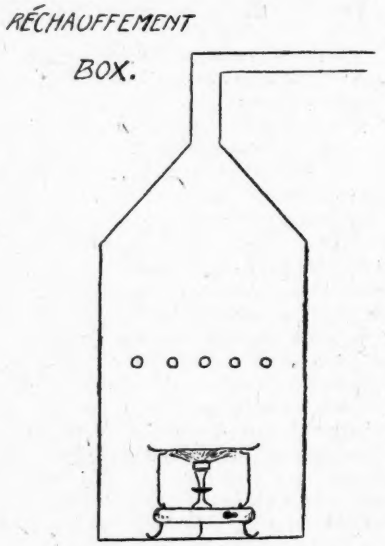


FIGURE I.

B.—Indications for Treatment of Shock.

From consideration of the actual recognizable changes in the circulation, the indications for treatment are:

(1) To relieve pain and, as far as possible, to mitigate the exciting cause of the condition of shock.
(2) To prevent further loss of heat.
(3) To supply warmth to replace heat lost. The means adopted to fulfil this indication are of importance.

The method of *réchauffement* used in dealing with the cases described is, from both practical and theoretical considerations, vastly superior to the older methods of using hot water bottles, etc..

A *réchauffement* box, constructed from an oil drum and some drain piping, into which a "primus" stove is placed, so as to supply heated vapour, as shown in

the accompanying diagram, was used in these cases. The patient is placed on a stretcher supported on trestles. Under the patient are two blankets and a waterproof sheet, whilst above there are two blankets supported on hoops, forming a kind of hot air chamber: the delivery pipe of the box discharges warmed moist air into this chamber. Ten to fifteen minutes' *réchauffement* by this method produces very marked improvement in a patient suffering from shock, collapse or exposure to cold.

This procedure is implied in cases where the term *réchauffement* occurs in the summary of cases. (Section VI.)

(4) To restore the depleted circulation and to improve the mechanical efficiency of the circulatory apparatus by raising the blood pressure and thus increasing the blood supply to the heart and vital centres.

(5) Should surgical performances become necessary, to use a system of anæsthesia calculated to depress the organism as little as possible.

Nitrous oxide and oxygen followed (in cases where muscular relaxation is imperative) by oxygen-ether has been found to fulfil this condition to the greatest advantage.

C.—Effects Produced by Hæmorrhage.

Capillary Stasis.—Examinations of the blood in cases of severe hæmorrhage have shown that the capillary red cell count is considerably lower than that found in primary shock, but the variation between capillary and venous counts is again marked, indicating stagnation in the capillaries, the capillary count being relatively high.

Fall of Blood Pressure.—The blood pressure falls in severe hæmorrhage, the mechanical efficiency of the circulatory apparatus is affected, cooling of the extremities occurs as a result of the diminished blood supply and stasis is induced just as in shock.

Fall of Hæmogloblin Percentage.—The hæmoglobin percentage shows actual lowering after severe hæmorrhage. Cannon has found the percentage of hæmoglobin relatively low compared with the red cell count. These blood changes have been confirmed in patients who have acted as blood donors, in whom shock is therefore excluded.

Blood Volume After Hæmorrhage.—Important observations made by Robertson and Bock (14), using the vital red method of Keith, Rowntree and Geraghty (15) on patients after hæmorrhage, have shown a remarkable reduction in blood bulk. Figures below 60% of the normal blood volume have been very frequently found.

By estimation of blood volume and hæmoglobin percentage the actual amount of blood loss was determined. Cases of severe anæmia following hæmorrhage showed a loss of as much as five-sixths of the total hæmoglobin.

Relation of Blood Pressure to Blood Volume.—Further, it has been demonstrated in the same series of observations that the blood pressure may remain normal with a blood volume reduction of 25% to 30%. Below this point, however, the adaptive mechanism which causes the vascular system to contract down on a reduced volume to maintain the adequate pressure, appears to fail. From here onwards the pressure falls *pari passu* with the volume.

A lowered blood pressure is therefore the most valuable single clinical indication of actual blood loss in hæmorrhage. A marked fall in pulse rate after the blood volume has been increased by blood transfusion or gum infusion may be taken as evidence of increased blood pressure. This has been confirmed by actual blood pressure readings in numerous cases of the series. (See Synopsis of Cases, Section IV.)

Effects of Blood Transfusion and Gum Infusion on Blood Volume.—

(*a*) Blood Transfusion.—The same observers (14) found that the restoration of blood volume after hæmorrhage was normally effected in great part by dilution of the blood by the patients' own body fluids, which, in the natural course of events, takes place comparatively slowly.

The process of restoration can be materially assisted by forcing the fluid intake *per os* and *per rectum*. It was, however, found that the process of blood dilution was dependent upon the hæmoglobin percentage; with greatly lowered hæmoglobin readings dilution would not take place beyond a certain limit. Hence the necessity for the addition of fresh hæmoglobin after severe hæmorrhage. Moreover, the increased activity of the bone marrow, as evidenced by the presence of reticulated red cells, seems to depend largely on the restoration of blood volume.

(*b*) Gum Infusion.—Studies of the effects of solutions of gum acacia in the same series of experiments led to the conclusion that, so long as the total hæmoglobin remaining in active circulation is over 25%, the blood volume could be efficiently restored by the intravenous injection of this solution.

A patient with hæmoglobin lowered to this extent, however, would be ill-fitted to stand further loss of blood by operation. For practical purposes the limit of safety in these circumstances would appear to be considerably higher, say, 30% to 35%, at least.

Effects of Reduction of Hæmoglobin in the Circulation.—Consideration of the great actual reduction of hæmoglobin in hæmorrhage and the potential reduction of the oxygenating capacity of the blood which must occur in severe shock, with great capillary stasis and failing circulation, makes it necessary for us to review the actual effects of hæmoglobin shortage in the organism.

"Acidosis" in Wound Shock.—The immediate effects of hæmoglobin shortage have been shown by Henderson (16) to result in a condition of anoxæmia, leading to an accumulation of CO_2, which condition has been called the "acidosis of shock."

However, the same observer has further demonstrated that a large amount of acid may be added to a bicarbonate solution similar in concentration to the alkalinity of the blood, before any considerable increase of acidity occurs, provided the CO_2 passes off. The hydrogen ions of the blood, then, do not increase to a marked degree, as long as pulmonary ventilation is efficient in preventing an accumulation of CO_2. Only when this process fails and the acids begin to encroach seriously upon the alkaline reserve of the blood does the respiratory centre become markedly affected, producing hyperpnœa.

These observations correspond with the clinical experience frequently noted, that hyperpnœa is found in the later stages of shock, indicating the presence

of an increased amount of CO_2. From personal observation of cases in this condition, the writer has come to regard hyperpnœa as of exceedingly grave prognostic import. Patients in this condition have frequently been observed to complain of pain and a sense of constriction in the diaphragmatic area, suggestive of a spasmodic contraction of the diaphragm. A search through the literature has failed to reveal adequate explanation for the cause of this symptom, which is almost invariably a prelude to a fatal issue.

Treatment of the "Acidosis of Shock."—Intravenous injections of solutions of sodium bicarbonate and glucose have been advocated in this condition, with the object of neutralizing the acid intoxication. These solutions have, however, yielded better results in dealing with acidosis produced in other conditions, such as wound infection by gas-producing organisms. It is obvious, moreover, that the rational indication is to replenish the impoverished hæmoglobin supply by blood transfusion, so as to restore the circulation before the morbid condition of anoxæmia has advanced to such an extreme degree.

D.—Restoration of the Circulation in Shock and Hæmorrhage.

From consideration of the changes in the circulation which have been described, apart from the general principles of treatment of shock, briefly outlined previously, the most urgent necessity exists for the employment of adequate measures to restore the efficiency of the circulatory mechanism. Whether it be necessary to supply fresh hæmoglobin immediately or whether restoration of blood volume by a colloidal solution would suffice, must depend ultimately upon the amount of hæmoglobin actually available to the organism at the time.

It has been stated above that life can be supported in animals in whom only one-sixth of their hæmoglobin remains, provided the blood volume is restored. These facts have been demonstrated in animals by the researches of Rous and Turner, at the Rockefeller Institute. It has also been pointed out that the practical minimum of safety, especially if operative performances be contemplated, is considerably higher than this.

After discussion of this question with many of the ablest workers in blood transfusion and army surgeons in the recent war, the writer concluded that the consensus of clinical judgement placed the practical limit for the use of colloidal solutions at a minimum of 25% hæmoglobin retention in the organism. In cases of profound blood loss beyond this limit, whether it be the actual blood loss of hæmorrhage or the relative loss of profound shock, it would appear to be a matter of urgent necessity to supply fresh erythrocytes. Exact figures on this point have not yet been determined. Further experimental investigation and clinical observation will be necessary before the exact scope for either method of treatment can be defined with mathematical accuracy.

In the series of cases here recorded an endeavour was made to form a clinical estimation by examination of pulse rate, blood pressure, evidence of actual blood lost, evidence of anoxæmia and such means as each individual case offered. A synopsis of results is recorded later. (Section IV.)

The question of the value of solutions other than blood or gum, such as normal saline, hypertonic saline, alkaline solutions, etc., is discussed in detail later under Section III..

III.—Intravenous Injections.

METHODS EMPLOYED IN TREATMENT.

A.—Blood Transfusion.

The methods used in cases of this series were:

(1) The "direct-indirect" transfusion, by means of paraffin-coated vessel.
(2) Citrated blood.
(3) Preserved blood.

Forty cases treated by these methods are described in detail under Section VI..

It is desirable to outline the principles underlying this procedure. A review of the literature on the subject of transfusion shows that the practice was one of antiquity. Of recent years only has the matter been reduced to scientific accuracy by the work of Crile (17), Moss (18) and others.

Moss confirmed and elaborated the previous work of Hektoen (19) and other observers, who had shown that human beings could be classified into groups with regard to the agglutinating and hæmolytic properties of the blood. A series of 1,600 specimens of blood from separate individuals was examined. It was found that, having regard to the power of certain sera to agglutinate and finally to hæmolyse the corpuscles of other individuals, four groups were recognizable, known as I., II., III. and IV..

If an average 100 sera be examined, they will be found to fall into the four groups as follows: Group I., 10%.; Group II., 40%; Group III., 7%; Group IV., 43%.

All individuals can be classified into these four groups, according to the ability of their sera to agglutinate the corpuscles of other individuals and according to the ability of their corpuscles to be agglutinated by the sera of other individuals. The same rule applies to blood with regard to iso-hæmolysins as to iso-agglutinins.

"The serum of any individual of one group may hæmolyse the corpuscles of another individual in any other group, except Group IV., but not the corpuscles of a member of the same group"—Moss (18). It will neither agglutinate nor hæmolyse the corpuscles of other members of its own group. The serum of any individual protects its own corpuscles from hæmolysis by any other sērum, but as soon as the corpuscles are removed from their own serum, they may be dissolved by other hæmolytic sera. Moss regards this as evidence that their receptors are free. "The anti-hæmolysin is an anti-amboceptor, which acts by blocking the cytophilic group of the amboceptor."

Hæmolysis is always preceded by agglutination. Obviously, in order to make blood transfusion a safe procedure in a given case, it is necessary to determine beforehand the reaction of the recipient's blood toward that of respective donors and to choose a suitable donor on this basis.

This might be accomplished by a direct test between the recipient's serum and the donor's corpuscles. The procedure has, however, been much simplified by the work of Moss in classifying all individuals into the four groups already referred to.

Moss's Classification.—

Serum of Group.	Cells of Group I.	II.	III.	IV.	Number of individuals per centum in each Group.
I.	0	—	—	—	Group I. = 10%
II.	+	0	+	—	Group II. = 40%
III.	+	+	0	—	Group III. = 7%
IV.	+	+	+	0	Group IV. = 43%

+ = Agglutination. — = No agglutination.
0 = No agglutination in an homologous group.

It has been shown that for the practical purposes of transfusion the only necessary consideration is that the serum of the recipient does not agglutinate the cells of the donor—Lee (20). It is, therefore, not necessary that a blood donor should belong to the same group as the recipient, since any action of the donor's serum upon the recipient's cells need not be considered, for reasons already stated.

It is seen from the table that the cells of Group IV. are agglutinated by no sera. Group IV. is therefore known as the universal donor.

Conversely, the serum of Group I. will agglutinate no cells. Group I. is therefore the universal recipient. For these reasons, it was found convenient in the series of cases recorded to use exclusively blood from No. IV. donors.

Method of Classification of Donors.—In order to determine the group to which a blood belongs, it is necessary to have known sera of Group II. and III. only. These sera may be kept in glass-stoppered bottles and have been found to keep indefinitely if a suitable preservative be added.

The following test method, as devised by Vincent (21) was adopted:

A drop of Group II. serum is placed on a clean microscopic slide and a drop of Group III. serum on the other end. A drop of blood from the ear of the prospective donor is diluted with a few drops of sodium citrate solution in a watch glass. A drop of the diluted blood is placed on the slide, close to each of the drops of serum. The corpuscles are then mixed with the serum with a clean glass rod, one end of the rod being used for each admixture.

The slide is then gently rocked in the hand for two minutes. At the end of this time agglutination may be detected macroscopically, if it has occurred.

Microscopic examination is more delicate, but the macroscopic method has yielded excellent results in practice. The following table shows at a glance to which group a prospective donor belongs:

Test Cells.	Serum II.	Serum III.	Group.
(*a*)	+	+	I.
(*b*)	0	+	II.
(*c*)	+	0	III.
(*d*)	0	0	IV.

+ = Agglutination. 0 = No agglutination.

Theoretically the donor's serum should be previously tested for the Wassermann reaction. Under the conditions of this series, however, this could not be done; it was found practicable to select healthy donors, who had no history nor evidence of syphilis.

The question of malarial infection is of importance, in that a case of artificial transference of the malarial parasite by blood transfusion has been recently recorded.

This subject of biological specificity of animal cells and body fluids is one offering great field for further investigation.

It has been reported by Shawan (22), that experiments have demonstrated that the principles of blood-grouping apply to the use of iso-grafts in skin grafting. Epithelial cells should belong to an individual of compatible group, in order to survive transplantation; if the graft has been taken from a donor of an incompatible group, it undergoes absorption.

These observations require further examination, Should the results receive confirmation, a path might be offered for the reinvestigation of certain aspects of the problem of new growths. The experiments of Crile (23), recording the disappearance of lymphosarcomata in dogs, after transfusion of blood from animals naturally immune, or which had undergone spontaneous recovery, appear also to be of great significance.

Methods Employed for Blood Transfusion.—

(*a*) The Direct-Indirect or Paraffined Flask Method.—A Kimpton-Brown's flask or Carrel's ampoule was dry sterilized and coated internally with paraffin wax. The method originally recommended by American authors, of heating paraffin wax to melting point and then pouring the molten wax into the flask, was first adopted. The writer subsequently found that a solution of flaked paraffin wax in ether was a more convenient medium for coating the flasks. This method came to be widely adopted.

Blood is collected from the donor by inserting the nozzle of the flask into the distal end of a vein, previously dissected out. The nozzle is then withdrawn and inserted into the proximal end of the vein of the recipient and the blood forced in gently by air pressure.

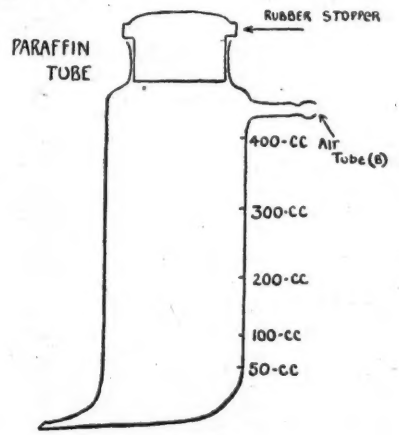


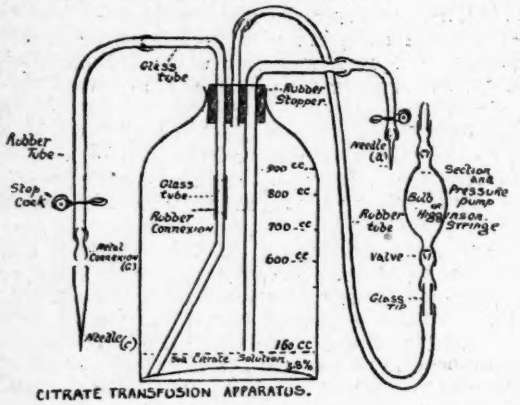
FIGURE II..

(*b*) Citrated Blood.—(1) Blood is drawn into a vessel containing an isotonic solution of sodium citrate. The apparatus designed by Captain Robertson, M.R.C., U.S.A., has been used extensively in this series and was found to give entire satisfaction. This method is particularly useful, in that blood could be collected beforehand and kept, if necessary, from one to two hours before use.

This apparatus can be readily constructed. It is sterilizable by boiling and is eminently satisfactory, never having failed to work satisfactorily in the hands of the writer.

(2) A simplified method of transfusion of citrated blood is employed in the Mayo Clinic. The vein of the donor is transfixed transversely by a fine intes-

tinal needle, pushed through the skin. A needle of wide bore, to which is attached a small length of rubber tubing, is then inserted into the vein. Blood is received into a graduated beaker containing citrate solution. The blood is then transferred to the vein of the recipient through a needle attached by rubber tubing to a glass funnel of 250 c.cm. capacity. A series of 1,036 cases transfused by this method has been reported by Pemberton (24).



CITRATE TRANSFUSION APPARATUS.

FIGURE III..

(c) Preserved Blood.—Rous and Turner (25), working at the Rockefeller Institute, showed that blood cells could be stored for several weeks under suitable conditions without losing their vitality.

Technique of Preservation of Blood.—A large glass Winchester bottle is required; 850 c.cm. of sterile isotonic dextrose solution (5.4%) is placed in the bottle. To this is added 350 c.cm. sterile isotonic sodium citrate solution (3.8%). Then 500 c.cm. of blood from a Group IV. donor is added. The vessel is placed on ice for four or five days, at the end of which time the red cells will be found to have formed a sediment at the bottom, with a clear, straw-coloured supernatant fluid. Colour changes in this fluid caused by hæmolysis indicate sepsis; the specimen must be discarded.

Before use the supernatant fluid is siphoned off and the total volume made up to 1,000 c.cm. with a 2.5% solution of gelatine in normal saline solution. Four cases were transfused by this method by the writer. It was originally intended to adopt this system for transfusion in advanced dressing stations. Owing to the technical difficulties met with in storing and transporting the blood, it was found more advantageous to use simpler methods. Asepsis is more difficult to maintain than in the citrate method described.

Large numbers of cases of successful transfusion by this system have been reported by Robertson and by Captain Walker, R.A.M.C..

Effects of the Introduction of Blood Into the Circulation.—

Survival of Corpuscles.—In studying the survival of transfused corpuscles, Rous and Turner (25) performed numerous experiments on rabbits. A large proportion of the rabbits' blood was withdrawn and replaced by preserved corpuscles. The fate of the transfused cells was followed by blood counts, hæmoglobin estimations, microscopic observations of the appearance of the blood elements, tests of urine for hæmoglobin, reticulated cell counts, etc.. It was found that erythrocytes preserved for fourteen days and then used to replace normal blood will remain in circulation and function so well that the animal shows no disturbance; the blood count, hæmoglobin and percentage of reticulated cells remains unvaried. Human cells will remain intact for at least four weeks.

Clinical Effects of Transfusion.—The striking and immediate result which follows transfusion in suitable cases is a marked general improvement in the patient's condition, accompanied by a rise in blood pressure and a slowing of the pulse rate. The difficulty encountered is to know how we are to recognize with certainty from clinical observation which cases are suitable. Moreover, a fine discrimination is required to estimate rightly the cases which will show an equal response to replacement of fluid loss by colloidal solutions of gum, etc.. A close and minute observation, lasting for several months, during which time many hundreds of cases were recorded, has led the writer to the conclusion that there is a definite sphere of usefulness for gum infusion, as well as for blood transfusion, and that each case must be judged on its merits by an observer skilled in these matters. The theoretical indications for the use of blood or colloidal solution have been previously considered. The question is further reviewed under Section V..

(To be Continued.)

INJURIES OF THE SPINAL CORD.[1]

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During the war cases of injury to the spinal cord occurred in considerable numbers. They were collected and investigated in special hospitals, with the result that our knowledge has been increased and our views revised by recent research. For this reason a discussion on this subject may prove of value.

Injury of the Spinal Cord Without Injury of the Vertebral Column.

The term concussion of the cord has been employed in a very loose manner to denote a cause of spinal symptoms, a definite clinical entity and a pathological state, so that considerable confusion has been caused. In this paper I wish to employ the expression to indicate the cause of the injury.

It has been definitely proved during the war that certain accidents, notably the explosion of a shell in close proximity to the patient, perhaps burying him, can produce gross lesions of the spinal cord without causing a coincident lesion of the spinal column. These lesions are not to be explained by a mysterious molecular disturbance of the cord substance, but are definitely recognizable microscopically. They are variable in extent and degree.

Holmes (1) states that the special character of these lesions is their diffuse and irregular distribution and their tendency to diminish gradually from the point

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of maximum disturbance. He has found foci of primary necrosis and parenchymatous change in cells and fibres associated with œdema and small scattered hæmorrhages. Claude and Lhermitte (4) report similar results.

It is difficult to explain the mechanism whereby a blow on the spinal column can produce lesions in such a protected structure as the cord without injuring the bone, but that such is the case has been proved experimentally.

In 1912 I performed a series of experiments in Sir Victor Horsley's laboratory (2) in order to determine the effect of slight injury upon the spinal cord. It was found that the cord was extremely sensitive to slight degrees of concussion and compression. Despite the slight anatomical changes demonstrable microscopically after minimal injuries, the resulting disturbance of function, as determined by cortical excitation, was considerable. As the cord was exposed by a laminectomy in these experiments, the conditions were obviously not those occurring in man.

I was permitted by Professor Osborne to continue these experiments in the Physiological Laboratory of the University of Melbourne. These later experiments, hitherto unpublished, had for their object the production of signs of interference in cord conduction by injury to the outer surface of the spinal column, not to the exposed cord. The animals employed were cats and monkeys. The spinal processes of three mid-thoracic vertebræ were removed and a weight dropped upon the exposed flat surfaces of the laminæ. I succeeded in producing signs of interference in cord conduction without causing a fracture of the vertebræ.

Figure I. illustrates an experiment of this type.

FIGURE I.
Extensor spasm in cat after concussion.

The cat has an obvious extensor spasm of the hind limbs, which indicates interference with motor conduction. This spasm gradually diminished in frequency and severity and finally disappeared after a few days. These experimental results have been confirmed by experience gained during the war.

The clinical signs following concussion have been described by Roussy and Lhermitte (3), who state that they are extraordinarily variable. The signs may be slight, but are frequently indistinguishable from those of an anatomical section of the cord, so that it is not possible at first to make a differential diagnosis. They describe definite clinical types: *forme quadriplégique, forme hémiplégique,* etc. In these cases motor and sensory functions are usually re-established in the course of a few weeks, though some permanent loss may remain.

They point out that, in these cases, the cerebro-spinal fluid is clear, containing no blood and no excess of cellular elements. This is an important point in establishing a differential diagnosis, no easy matter in some cases.

We must conclude that lesions of the cord can occur as a result of concussion, that these lesions may be slight or severe and that the clinical signs produced by them are very diverse, ranging from cases resembling hysteria at one end of the scale to those at first indistinguishable from an anatomical section at the other. In the treatment of industrial accidents in which an explosion has occurred, it is necessary to remember these facts before deciding upon an exploratory operation.

There is another definite type of cord injury unaccompanied by vertebral injury which merits separate description. I refer to the condition known as hæmatomyelia, *i.e.*, hæmorrhage into the grey matter of the spinal cord. This may be merely an incident in a general crushing injury of the cord, but it also occurs as a focal lesion. The hæmorrhage is usually in the cervical region and is caused by a fall on the head, producing acute flexion of the neck. The grey matter of the cord is more vascular than the white and at the same time the vessels are less supported by connective tissue. It is easier for the effusion of blood to pass up and down in the grey matter than to pass outwards into the more resistant white matter. The resulting clinical picture is distinctive. There is a flaccid paralysis of the upper limbs, due to hæmorrhage into the anterior cornua, and a spastic paralysis of the lower limbs caused by the pressure of the blood upon the lateral cortico-spinal motor tracts. The motor paralysis soon commences to subside; the residual signs depend upon the extent of the initial lesion, though usually some weakness remains. The sensory loss, when the hæmorrhage is confined to the grey matter, is distinctive. There is an anæsthesia of thermal and pain sense without any impairment of the sense of touch. This condition has been well described by Bailey (5), and is more common than is usually supposed.

The area of sensory loss depends upon the degree of extension of the hæmorrhage downwards. In many cases it does not extend below the lower thoracic segments.

Injury of the Vertebral Column Without Injury of the Spinal Cord.

It is well known that fracture of the vertebral column can occur without simultaneous cord injury. I have collected the literature and reported nine additional cases of this type of injury in a former paper (6) in this *Journal,* but wish now to draw attention to one complication of this group of injuries. In cases where a fracture of the vertebral bodies has occurred, a rarefying osteitis may follow. As a result kyphosis may be produced, giving rise to pressure upon the spinal cord. This condition is known as Kümmel's disease, and is illustrated in Figure II.. This case has already been reported (6).

Two months after a fall on the head the man noticed that his head was falling forwards. This deformity was followed by the development of weakness in the upper and also the lower limbs. These symptoms subsided after a laminectomy had been performed. I removed the laminæ of the fifth, sixth and seventh cervical and the first thoracic vertebræ. The X-ray picture showed collapse of the bodies of the lower three cervical vertebræ, due, doubtless, to a rarefying osteitis following fracture. Two years after the operation the man was in good health and had returned to his former occupation.

Injury of Both Spinal Cord and Vertebral Column.

I wish to discuss this large group of spinal injuries with special reference to the indications for operation.

Prior to the war Horsley and others advocated an early operation in this type of injury in all doubtful

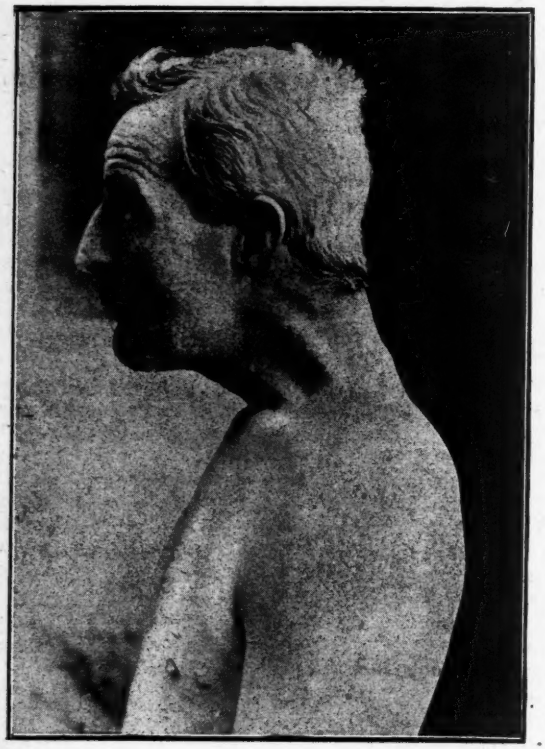

FIGURE II..
Kyphosis due to rarefying osteitis following fracture of the vertebral bodies. Pressure on the cord relieved by laminectomy. Kümmel's disease.

cases. The results were not encouraging and caused many surgeons to take a more conservative view. It is necessary to define what we hope to achieve by operation. Despite the advice of Mayo-Robson to replace the destroyed segment of spinal cord by a graft of the spinal cord of the rabbit, it is realized that all we can do at present is to relieve pressure upon the spinal cord when this is found. This step is only successful in cases where the spinal cord has not been completely divided by the force producing the lesion.

The extent and nature of the lesions of the cord have been demonstrated by Holmes (1).

Where the cord has been completely divided, there is, as a rule, a considerable amount of clot and fragments of bone between the two ends.

In injuries of lesser intensity there may be disintegration of a portion of the cord and a semi-fluid, custard-like material may escape on pricking the pia. The whole cross section may be blurred or there may be discontinuous foci.

If the injury be slight, the normal structure is only obscured and there may be slight hæmorrhages.

Subdural hæmorrhages of considerable size may occur, but are rarely large enough to compress the cord—a point of some interest.

Secondary degenerative changes occur in the neighbourhood of the primary. These are degenerative in type rather than inflammatory. Œdema is present, affecting the neuroglial matrix as well as the nerve cells.

In addition, distant lesions are found extending for four to five segments on each side of the site of injury. These include œdema, small hæmorrhages, swelling of axis cylinders, focal necroses and formation of cavities.

There is, therefore, a wide-spread injury to the spinal cord of variable degree in traumatic lesions.

As Walton (7) has pointed out, this injury to the cord is the result of the momentum of the body and is caused at the moment of injury. It must not be confused with the continuous pressure exerted by depressed bone, if this also be present. Any increase in destruction of the cord due to irritation around or pressure of a foreign body or depressed bone, will appear only after an interval. It is not essential, therefore, to remove this pressure at once.

Many cases have been reported in which the dura had not been perforated by depressed bone, and yet after removal of the latter, permanent paraplegia has remained, because the force of the primary impact was sufficient to destroy the cord. In these cases the result of what appeared at first to be a very hopeful operation, was disappointing in the extreme. We must realize that nothing can be done to repair the initial injury of the cord and that when the signs of a complete lesion are present, operation is contra-indicated. If a partial lesion is diagnosed, an operation should be performed in those cases in which it seems probable that there is continued pressure upon the cord. If improvement in the signs of a partial lesion are not maintained, then also an exploratory operation is indicated. In all cases operation should be delayed until it is possible to differentiate between a partial and a complete lesion of the cord, for in the majority of partial lesions the signs are at first similar to those observed in complete division. It is obviously necessary to have a clear idea of the clinical signs indicating complete and incomplete lesions. These have been described by Riddoch (8) in a very able paper. He states that Bastian's view that a complete lesion of the cord is accompanied by flaccidity of the affected limbs and absence of all tendon reflexes, is wrong. He recognizes three stages in the history of these cases.

Stage I.—There is at first a period of flaccid paralysis with hypotonia, complete sensory loss and abolition of all reflexes, except that tonic contraction

of the bladder and rectal sphincters persist. This stage lasts for a variable period, usually from one to three weeks.

Stage II.—(a) In complete lesions.—Reflexes, many of them complicated and showing adaptation to an end, can be evoked from an increasing reflexogenous area by a decreasing stimulus. These reflexes are flexor in type and overflow into other reflex arcs, so that, soon, a small stimulus causes an extensive response. To this phenomenon the name "mass reflex" is applied. This comprises flexor spasm of the abdominal wall, both lower extremities, evacuation of the bladder when its contents are half the amount at which it would otherwise empty itself, and sweating from an area of skin varying with the level of the lesion. At a later date knee and ankle jerks can be elicited, but these are not well sustained.

(*b*) In partial lesions.—In this group extensor or static reflexes return at the same time as the flexor. The reflexogenous area is much more limited. Local signature is present, *i.e.*, there is not the same wide spread of the reflex. The knee and ankle jerks return earlier and are well sustained. Extension of the contra-lateral limb may occur, simulating a movement of progression. An extensor thrust may be elicited by pushing up the distal portion of the sole of the foot.

Stage III.—In the presence of septic complications, the reflex activity disappears and the limbs pass again into a state of flaccidity.

It will thus be apparent that in complete lesions the clinical picture resembles that seen in a spinal animal, whilst in an incomplete lesion it is comparable with that of a decerebrate animal and obviously depends upon the integrity of certain proprio-spinal paths.

Milder cases of spinal injury are more obviously incomplete. In cases I. and II., for example, there was not a total sensory loss, the clinical picture being that of a Brown-Séquard syndrome.

Prior to the publication of Riddoch's paper I performed a laminectomy in a case presenting the flexor type of reflexes with knee and ankle jerks present, in the belief that these indicated an incomplete lesion. Possibly others have been similarly misguided.

In order to determine the type of vertebral injury, radiographic examination should be carried out in all cases of this nature. I wish to emphasize the importance in thoracic lesions of taking the X-ray picture in an oblique position, so that the shadow of the vertebral bodies is thrown in front of that of the spinal arches. In cervical and lumbar injuries a lateral view can be taken. It requires the eye of faith to detect a depressed fracture of the laminæ in an antero-posterior view of the spine.

No results are more satisfactory than those following a successful laminectomy for the removal of pressure upon the cord, but the indiscriminate exploration of these injuries is calculated to bring this operation into undeserved disrepute.

In the early stages operation should not be performed unless the signs indicate an incomplete lesion and it is believed that there is pressure upon the cord. In the later stages of the case it is indicated when a relapse occurs.

This relapse may be due to:—

(1) Contraction of scar tissue.
(2) Pressure from exuberant formation of callus.
(3) *Meningitis serosa.* This is a condition of chronic spinal meningitis described by Horsley (14).
(4) Kümmel's disease, already referred to, in which pressure upon the cord is the result of the bony deformity.

In all these complications the result of a laminectomy is very satisfactory.

Lesions of the Corda Equina.

In these lesions, on the other hand, operation should not be delayed. It is not yet definitely determined whether regeneration can occur in the nerve roots, but I know of one case in which a regeneration neuroma was found upon the central end of a divided root. This supports the belief that, where possible, the roots should be sutured as soon as possible.

Another indication for early operation is demonstrated in case III., where the presence of a shrapnel pellet in the canal gave rise to very severe pain, owing to pressure upon the sensory nerve roots.

The Care of the Bladder in Spinal Lesions.

The late Dr. Fearnsides (9) has summarized the work done during the last few years upon the innervation of the bladder and urethra. Head and Riddoch (10) have described the automatic bladder in gross injuries of the spinal cord. Thomson Walker (11) has published a paper on "The Bladder in Gun-Shot Injuries of the Spinal Cord." Reference should be made to these papers for more complete information on this subject.

Gaskell and Langley have proved that the bladder receives a double nerve supply from the hypogastric nerves (from the thoraco-lumbar autonomic system) and the pelvic nerves (from the sacral outflow). Both nerves contain afferent and efferent fibres. The preganglionic fibres of the thoraco-lumbar supply to the bladder form synapses around ganglionic cells in the inferior mesenteric ganglia. The ganglion cells of the sacral outflow are actually in the wall of the bladder in the hypogastric plexus.

These two nerve supplies are functionally antagonistic to each other. The pelvic nerves carry impulses causing contraction of the detrusor mechanism and inhibition of the sphincter mechanism of the bladder. The hypogastric nerves, on the other hand, initiate and maintain a contraction of the sphincter musculature and, in some animals, inhibition of the detrusor musculature. The latter action probably does not occur in man.

There are three centres controlling this nerve supply. These are situated in the peripheral ganglia, the spinal cord and the cerebrum. The central nervous system integrates afferent and efferent impulses from the bladder and maintains the static tone of the organ. The wall of the bladder is thus held in a state of constant postural contraction, gripping its contents lightly, whether the amount be large or small. When the cubical content of the bladder reaches a certain amount, reflex emptying takes place. Rhythmical contractions of the detrusor musculature increase in amplitude with increasing distension. Afferent impulses are thereby increased and lead to

a discharge of pressor impulses by the pelvic nerves to the muscle of the bladder wall and inhibitor impulses to the sphincter musculature, thus emptying the bladder.

This reflex process is present until the second year of life, when retention and evacuation can be controlled by voluntary effort.

In cord lesions two distinct stages are observed:—

Stage I.—Complete retention.—There is active contraction of the bladder sphincter. Feeble contractions of the detrusor musculature occur, but are insufficient to overcome the sphincteric resistance. When the bladder becomes very distended, overflow incontinence results, small amounts of urine dribbling constantly from the meatus.

Thomson Walker (11) states that the average duration of this stage is 55 days. In a large number of cases it varied from twenty-four hours to eighteen months.

Stage II.—Reflex micturition.—In this stage the bladder empties reflexly when its contents reach a certain set capacity. This is the permanent state in severe cord injury. If cystitis be present, the bladder contracts very much and may have a capacity as low as 30 to 60 cubic centimetres. There is a transition period between these two stages during which contraction of the detrusor mechanism can expel a small portion of the bladder content.

The condition of flaccidity of the bladder and sphincter, resulting in paralytic incontinence, was not present in any of the cases. This condition was formerly described as characteristic of a lesion of the lumbar cord or *cauda equina*. These results support Gaskell's view that there is a centre for micturition situated peripherally in the hypogastric ganglia.

The problem that concerns us is how to prevent urinary infection during the first stage before the commencement of reflex micturition, *i.e.*, to give the patient a clean automatic bladder. It is estimated that 80% of patients with spinal injuries died of renal infection during the war. If this complication is avoided and reasonable care is taken to avoid bed sores, paraplegics can live for years in comparative happiness.

The first essential is to prevent distension of the bladder. It has been found experimentally in animals that if the bladder distension is not relieved, hæmorrhage and ulceration occur in the bladder wall. Distension of the bladder causes increased pressure in the renal pelvis. This leads to an aseptic nephritis and renders the kidney less resistant to infection. Distension of the bladder also delays the onset of reflex emptying and may give rise to atony or cystitis and fibrosis.

Four methods of treatment are advised:—

(1) Catheterization.
(2) The tied-in catheter.
(3) Manual expression.
(4) Supra-pubic cystotomy (*a*) primary, (*b*) secondary.

(1) *Catheterization.*—This is the usual method. The catheter should be passed three times in each twenty-four hours. A bladder wash-out should be given once or twice daily. The fluid employed varies with the reaction of the urine. When this is acid, potassium permanganate, 1 in 8,000, or silver nitrate, 1 in 10,000, should be used. If the reaction is alkaline an acid wash, such as boric acid, together with an occasional irrigation with acetic acid (6.25 grammes to the litre), gives better results. Care must be taken to avoid distension of the bladder during the irrigation. The irrigator should not be more than 60 cm. above the patient and only 90 c.cm. should be run in at a time. This method requires constant care and attention on the part of the surgeon, but if this is available, the results are satisfactory. In two cases I have controlled a severe cystitis by frequent catheterization and irrigation. Both the patients are alive five years after the occurrence of the paraplegia, which has remained complete.

(2) *The tied-in catheter.*—Kidd (2) is a strong advocate of this method. He states that he employed it consistently throughout the war, with good results. After the urethra has been well irrigated with oxycyanide of mercury (1 in 30) 6.25 grammes to the litre of water, a well lubricated catheter is passed into the bladder and tied in. A bladder wash out with the oxycyanide solution is given daily. The catheter is removed every fourth day, the urethra irrigated and a fresh catheter tied in.

Thomson Walker regards a tied-in catheter as useful as a temporary expedient, but states that, if continued, it gives rise to a purulent urethritis.

(3) *Manual expression.*—This method was tested at Boulogne, where a number of men with spinal injuries were concentrated in one hospital. Vellacott (13) has published the results. The method is simply to apply pressure to the bladder through the anterior abdominal wall and so to express its contents. Vellacott's results are not encouraging. He points out that in the early stages expression is difficult owing to the strong sphincteric resistance. If infection is present, expression is dangerous and may cause rupture of the bladder or aggravate the cystitis. He suggests that the bladder should be permitted to distend and overflow and that temporary paralysis of the sphincter by mechanical dilation should be achieved. This suggestion, which must be considered a counsel of despair, at least indicates that his extensive experience of expression of the bladder was not encouraging.

(4) *Suprapubic cystotomy.*—This method was first suggested by Horsley. During the war Thomson Walker has suggested its use, either as a prophylactic measure in the early stages or as a method of treatment when cystitis has occurred.

The prophylactic cystotomy should be performed before a catheter has been passed at all. A self-retaining catheter is inserted into the bladder, which is thereby drained until reflex emptying begins. Various objections have been urged to this method. It is difficult to keep the bladder opening water tight. If an automatic bladder becomes established, the suprapubic opening may not remain soundly healed. The bladder is said to become infected easily through the suprapubic opening. Further investigation, which is necessary, may prove that these objections are not valid.

The operation is of value in severe cystitis. In these cases two tubes should be introduced into the bladder and continuous drainage maintained through

a Hamilton Irving apparatus to prevent soiling of the bed.

When many methods of treatment are advised, the obvious inference is that none of these is completely satisfactory. This is our unfortunate position in regard to our knowledge of the care of the bladder and I am quite unable to state pontifically which of these methods is the best. No form of treatment can prevent infection with certainty, nor can any render sterile an infected bladder.

Further investigation of the various methods is necessary. It is easier to control these cases under peace-time conditions than during war and I advise the old method of catheterization performed with meticulous attention to aseptic principles combined with a daily irrigation of the bladder. If cystitis occurs and resists treatment by frequent irrigation, then a cystotomy should be performed before the onset of severe renal infection. In view of Vellacott's results I do not advise the adoption of the method of expression of the bladder, but further investigation of the other two methods should be undertaken.

Operative Technique.

I do not propose to consider this in detail, but wish to direct attention, in the first place, to the value of local anæsthesia in the operation of laminectomy.

In cases II. and III. this method was employed. The anæsthetic used was a ¼% solution of kerocain, with 1 in 10,000 adrenalin. A preliminary injection of omnopon and scopolamine was given one hour before the operation. The injection should surround the area of incision and, after superficial infiltration of the fascia and muscles, the needle should penetrate to the superficial surface of the laminæ to be removed. It is then insinuated under the caudal border of the laminæ to be removed, in order to infiltrate the deep surfaces. The resulting anæsthesia was eminently satisfactory in these two cases. In case III. ether was administrated for a short period, whilst the shrapnel pellet was being extracted from the *cauda equina*. I believe that in cases where intra-dural exploration is necessary, the local anæsthetic could be introduced through the dura and the whole operation performed without the administration of a general anæsthetic. The advantages of this method are obvious in upper thoracic lesions where respiration is mainly diaphragmatic. Another advantage of local anæsthesia is that the adrenalin diminishes the hæmorrhage considerably.

The best method of opening the spinal canal is to make a burr opening through the apex of the spinal arch after removal of the spinous process and to enlarge this opening with a small parrot-bill *rongeur*. In this way it is easy to avoid any additional injury to the cord and, further, the time spent in removing the laminæ is reduced to a minimum.

Illustrative Cases.

Case I.—It was quite rare to see a patient in hospital suffering from a bayonet wound, other than those wounds of the buttock caused by sliding into a trench against the wall of which is resting a rifle with bayonet fixed. In this case the patient, a German, survived three bayonet wounds, one of which fractured the tenth dorsal lamina and caused a Brown-Séquard paralysis.

W.G., age 22, German infantry regiment, was admitted to hospital in 1917.

He states that he was attacked by an Australian soldier. He received a bayonet thrust under each nipple and on turning to run away, he felt a more severe thrust in the back and fell to the ground paralysed in both legs. He was taken prisoner and subsequently evacuated to the base in the ordinary way.

On admission, 7 days after his injury, he was in good condition and his temperature and pulse-rate were normal. There were two small granulating wounds on the ventral chest wall, one under each nipple. Neither of these had penetrated the chest. A similar small wound was found on the dorsal wall of the thorax at the level of the tenth thoracic spine. A general examination revealed nothing else abnormal.

Examination of the nervous system.—An area of hypoæsthesia was found on the right side below the level of the 12th thoracic segment. The patient could detect a moderately firm cotton-wool touch, but stated that it was not so distinct as a light touch elsewhere on the body. On the left side he could perceive and localize light touch accurately. On the right side below the 12th thoracic segment a pin prick evoked a most painful stimulus, causing the patient to cry out with pain. On the left side below the 2nd lumbar segment he was unable to differentiate between the sharp and blunt ends of the pin. He could differentiate between hot and cold test tubes equally well on both sides.

The sense of muscle position was completely absent in the right lower limb. It was unimpaired on the left side.

There was no voluntary movement in the right lower limb. A very slight spasticity was present. In the left lower limb power, nutrition and tone of the musculature were normal.

Knee and ankle jerks were not elicited in either side. No clonus was elicited. The plantar reflex was extensor in type on the right side and flexor on the left. The right and left upper abdominal and the left lower abdominal reflexes were present. The right lower abdominal and the right cremasteric reflexes were not elicited. Reflex emptying of the bladder took place every four hours (approximately). There was a history of overflow incontinence for twenty-four hours, necessitating catheterization at the casualty clearing station. The urine contained pus, bladder epithelium and some red blood cells. The pus disappeared after bladder irrigation had been performed twice daily for a week.

As the history of the case suggested a depressed fracture of the vertebral arch, a laminectomy was performed 14 days after the date of the wound.

The scar was excised and a fracture of the lamina of the 10th thoracic lamina was exposed. This lamina and the 9th and 11th thoracic laminæ were removed, thus freely exposing the dura. A depressed fragment of bone had constricted the dura without perforating it. There were no other signs of injury, so the dura was not opened and the wound was sutured.

There was no post-operative reaction and the wound healed without incident. Five days after the operations slight movement was possible at all the joints of the right lower limb. Three weeks later the range of movement was complete, but there was very little power. At this time there was a decided improvement in the sensory signs. The hyperalgesia had disappeared and the other disturbances were less marked.

The patient continued to improve and eight weeks after the operation, he was evacuated to England as a "walking case." Before this occurred I had been transferred to another hospital, so am unable to state the details of his neurological condition at the time of his discharge from hospital.

Case II.—In this case a through-and-through wound of the thorax detached portion of the vertebral arch, which compressed the cord and caused a similar Brown-Séquard syndrome.

W.G., Pte., 118, U.S.A. infantry regiment, was wounded on October 10, 1918, and admitted on October 13, 1918.

There was a through-and-through wound of the right side of the thorax. The entrance was just above the right nipple and the exit was situated immediately lateral to the

8th thoracic spine on the right side. A right hæmo-pneumothorax was present and on the day following admission 1.2 litres of blood-stained fluid were aspirated. Pericardial friction was detected and there was a consolidation of the upper lobe of the right lung.

Examination of the nervous system.—Sensory examination revealed absence of epicritic sense and sense of muscle position on the right side, extending as high as the 11th thoracic segment. Pain and thermal sense were lost on the left side to a slightly higher level.

There was complete paralysis of the right lower limb and very definite weakness of the left lower limb. On this side the range was normal, but there was very little power.

The plantar reflex was extensor in type on the right side and doubtful on the left. The right knee jerk was absent and the left was definitely exaggerated.

The bladder emptied reflexly.

X-ray examination revealed a fracture of the transverse process of the 8th thoracic vertebra and a probable depression of the arch of this vertebra.

The condition was, therefore, a Brown-Séquard paralysis, with, in addition, slight involvement of the left pyramidal tract.

At this stage Colonel Fairfax, whose help in this case I wish gratefully to acknowledge, transferred the man to my ward for operation.

It was obviously undesirable to administer a general anæsthetic; local anæsthesia was consequently employed and proved completely successful. A semi-circle of pedicle and lamina had been detached on the right side and was compressing the right half of the cord. The dura had not been lacerated and was not opened.

The patient was evacuated one month after the operation. His wound had healed by first intention. Range and power of movement in the left lower limb were normal. In the right lower limb voluntary movement was present in all the muscle groups and was steadily increasing in power. The sensory disturbances had almost disappeared.

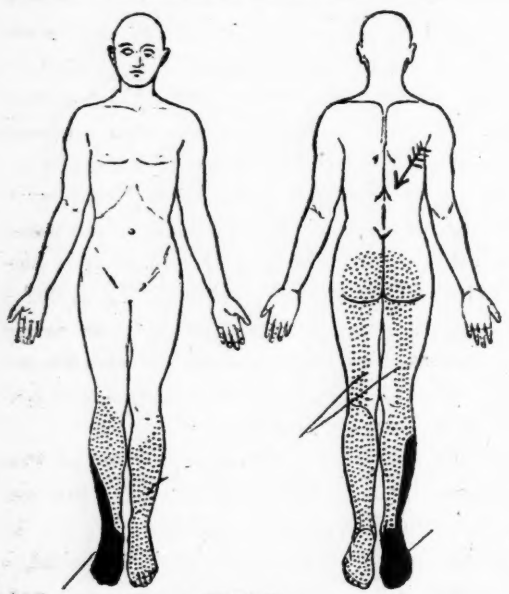

FIGURE III.
Cauda Equina Lesion.
Black: Complete loss in 5th lumbar and 1st sacral segments.
Dotted Area: Partial loss in 4th lumbar and 5th sacral segments.
The arrow indicates the direction from the entry wound in the right posterior axillary line.

The record of this patient's progress have not yet been filed at Washington, so I am unable to state what his present condition is.

Case III.—In this case a shrapnel pellet lodged in the spinal canal at the level of the first lumbar vertebra.

Cpl. E.G., Gordon Highlanders, was wounded on October 26, 1918, and admitted on October 29, 1918.

A small entrance wound was present in the right axilla. No exit wound could be found. The patient complained of very severe shooting pain down both legs.

On examination there was found a consolidation of the base of the right lung, with friction at the base of this lung and in the right axilla.

Examination of the nervous system.—There was complete loss of all forms of sensation in the segmental distribution of the 5th lumbar and 1st sacral nerve roots on the right side. There was a partial loss of all forms on both sides from the 4th lumbar root caudalwards (see Figure III.).

On the left side there was voluntary movement at all the joints of normal range, but deficient power. On the right side there was complete loss of voluntary power in the muscles of the foot and ankle and also in the hamstring group. The other muscles of this limb were capable of weak voluntary movement.

X-ray report.—A shrapnel pellet in the spinal canal at the level of the 1st lumbar vertebra.

The bladder was emptying itself reflexly, but the urine contained large quantities of pus, so a bladder irrigation was given twice daily.

Operation (October 31, 1918).—Under local anæsthesia a laminectomy of the 12th thoracic and 1st and 2nd lumbar vertebræ was performed. A general anæsthetic was administered for a few minutes while the dura was rotated and the shrapnel ball extracted through its aperture of entry, which was situated on the ventro-lateral aspect of the dura. It had partially divided the 5th lumbar root. The pain disappeared immediately after the operation. The wound healed by first intention.

For details of the further progress of this case I am indebted to Dr. Allen, of Glasgow.

One year after the operation slight voluntary extension and flexion of the right ankle was possible. This was definitely increasing in amplitude. Movement in the left lower limb was normal and the patient was able to walk about on crutches. Protopathic sensation had partially returned, but there had been no return of epicritic sensation.

In England the cystitis had become more severe, necessitating a suprapubic cystotomy. This had a temporary effect on the cystitis, but there was still a quantity of pus in the urine when the operation wound was allowed to heal.

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The Medical Journal of Australia.

SATURDAY, JULY 10, 1920.

The Queensland Referendum.

The members of the Queensland Branch have resolved to advocate the expedient of prohibition and to recommend the people to give this proposal favourable consideration. From the summary of the discussion which appears on another page, it will be seen that a referendum will be held in October of this year, as prescribed by the *Liquor Act, 1920*. The people will be asked to choose between the *status quo*, the State control of the liquor traffic and prohibition of manufacture, importation and sale of alcoholic beverages. The nature and extent of the control that might be exercised by the State Government has not been disclosed. In these circumstances, almost every speaker presented the problem as one involving the acceptance of the "devil you know" or the "devil you do not know." Everyone has experience of the condition obtaining at present. It is true that many of the facts have not been elicited and that beliefs abound where accurate information should be found. The continuance of the *status quo* is unpalatable to every thinking individual. Governments have the unhappy knack of doing the wrong thing. Indifferent or bad administration has too often been given to the Australian people for us to be content to take a leap in the dark. It is possible that a better solution than prohibition might be found, but it is probable that the control exercised by the State Government would be anything but a remedy for one of the most destructive evils known to mankind. By a process of exclusion, rather than by one of deliberate choice, the members of the Queensland Branch have determined that the reply to the questions should be that prohibition should be introduced.

It is an unfortunate fact that intemperance in argument is the rule when religion or the alcohol question is the subject. Neither side is prepared to rely on a moderate review of facts. The advocates of total prohibition of the manufacture and sale of alcoholic beverages present so exaggerated a case that the doubter would be inclined to join the ranks of those who object to this extreme measure, were it not for the distorted recital of alleged facts presented against prohibition. The physiological action of alcohol on the human organism has been studied by numerous observers. It is strange to relate that only the very obvious effects have been demonstrated with certainty. That alcohol can induce an acute form of poisoning cannot be denied. In the state of drunkenness human beings commit acts of a damaging kind, damaging to the individuals themselves and damaging to others. Continued abuse of alcohol, usually spoken of as alcoholism, is associated with degenerative changes of the arterial system and of the nervous tissue. Indirectly chronic abuse of alcohol may lead to cirrhosis of the liver, but it has been demonstrated beyond cavil that the so-called "gin drinker's liver" occurs at times in an individual who has not tasted alcoholic drinks. It has been claimed by some extremists that even the smallest quantity of alcohol produces a damaging effect on the tissues and impairs the mental capabilities of the individual. There is experimental evidence that the feeling of *bien être* and of increased working capacity after a small quantity of an alcoholic beverage is entirely subjective. Even a single glass of wine renders the average man less efficient in mental activity, although the depreciation is usually extremely slight. There is still much to be learned of the effect of small quantities of alcohol on the tissues of the body. The opponents to prohibition claim that wine taken in moderation, is benefieial. The evidence on which this claim is based, is largely of the nature of impressions. Few measurements are available and precise knowledge concerning the alleged benefits provided by the nectar is lacking.

The conclusions of the famous Committee of Five have fallen on deaf ears, because they were little convincing. Greater promise attached to the inauguration in 1912 by Count Louis Skarzynski, a Russian diplomat, of *Le Comité Internationale pour l'Étude Scientifique de la Question de l'Alcool*. The Russian Government empowered Count Skarzynski to invite the governments of all other countries to join in this very estimable investigation. Some governments accepted the invitation at once; others gave a sort of tacit approval to the scheme and agreed to

give the question of official recognition favourable consideration at a later date. A few governments stood aloof. The programme was drawn up at the first meeting held at the *Collège de France*, in Paris, on January 28, 1913, under the presidency of M. Emil Loubet. It was determined that the physiological, statistical and social facts should be collected by competent and unbiased scientists. In the next place those whose training and experience gave them the ability to weigh evidence, were asked to consider the facts ascertained and to estimate their relative significance. In the last place, the suggestion of remedies was to be left to men qualified for this kind of work by life-long study of social and legislative expedients. Unfortunately this international committee had not progressed beyond the initial stages of the work when the great upheaval removed all immediate prospects of the completion of the plan. The British Committee had arranged a comprehensive programme, which included the investigation of the questions whether alcohol possesses a food value or not, why men indulge in alcoholic beverages, what effect alcohol exercises on the body in varying amounts and in varying strength, what are the principal causes and the principal effects of alcoholism and what are the means employed to combat alcoholism, as well as what are their results. The True Temperance Association was able to show a distinct reduction in the number of convictions for drunkenness and for violence by inebriate persons as a result of the reform of public houses and the displacement of of drinking bars by restaurants where drink was served only with meals. This improvement has been maintained during the war. On the other hand, the prohibition of the manufacture of *vodka* in Russia during the years immediately preceeding the war proved a miserable failure, partly because the State was unable to effect a complete prevention of manufacture and partly because this drastic measure naturally provoked opposition in a not inconsiderable proportion of the people. This evidence collected before the war is no doubt very meagre and quite insufficient, but it indicates the necessity for further investigation and provides us with a hint as to the wisest method of inducing human beings to modify their habits. The reports concerning the effect of prohibition in America are so contradictory and so astounding that a calmer estimate of its effects must be awaited before a lesson can be learned from the United States. We have recently recorded the experience of competent observers which tends to show that the introduction of prohibition was accompanied with an alarming spread of methanol poisoning. It is possible that this result was but temporary, but it certainly suggests that the drunkard will find some solace if deprived of his illusory comforter. If there can be discovered an acceptable measure to check alcoholic abuse without creating a condition as bad, this measure should be adopted. The *Liquor Act* of Queensland does not provide for any means of moderate reform and consequently the only sane reply to the question is the acceptance of prohibition.

EXPERIMENTAL DIABETES.

In a recent issue an account was given of Dr. Frederick M. Allen's researches on carbo-hydrate feeding of dogs who had been deprived of the greater part of their pancreas. Three new chapters have been added to this work. The subjects are the effects of protein diet, the control of experimental diabetes by fasting and total dietary restriction and various failures of dietetic treatment and their causes.[1] The author sets himself the task of proving that the cause of the earlier appearance of glycosuria in mildly diabetic dogs after feeding with starch than after feeding with protein is not merely due to rapidity of absorption and metabolism. The glycosuria from starch generally lasts for six to twelve hours; it has been shown that protein does not require longer for absorption and deamination. He adduces evidence of the cumulative effect of carbo-hydrate. In the third place he shows that protein causes but little hyperglycæmia in mild diabetes, while in severe diabetes it gives rise to a blood sugar curve similar in all respects to that of carbo-hydrate in mild diabetes. He therefore concludes that the restriction of preformed carbohydrate is more important in the treatment of diabetes than the restriction of protein. He proceeds with an inquiry into the relative importance of different forms of protein under conditions of impaired protein metabolism. It has been stated that when pancreatic juice is deficient, the improvement of digestion resulting from pancreas feeding may increase the glycosuria. Dr. Allen's experiments reveal that pancreas does not differ at all from other protein-containing substances in regard to the production of glycosuria. Therapeutically pancreas has been proved to be quite inert in diabetes. He was unable to detect any difference in the metabolism when the dogs were fed on cooked meat or on raw meat. In the next series of experiments the author sought to discover whether dogs rendered diabetic by the removal of the greater part of their pancreas but kept sugar-free by diets restricted in carbo-hydrate and protein content, would

[1] *The Journal of Experimental Medicine*, May, 1920.

live in moderate health indefinitely, or whether they would sooner or later break down under the load of the disturbed carbo-hydrate metabolism. He recognized that it was necessary to exclude animals in whom compensatory hypertrophy of pancreatic tissue was leading to spontaneous cure. Four dogs were selected for this purpose. The first dog became severely diabetic and the numerous tests carried out to determine its tolerance to varying amounts and kinds of carbo-hydrates and proteins were always followed by hyperglycæmia and heavy glycosuria. It died of diabetes. The second dog was also suffering from severe diabetes. Dr. Allen states that it might have been rendered sugar-free with under-nutrition, but apparently this was not done. The dog died. The two other dogs had mild diabetes. They were kept sugar-free on restricted diet, but revealed a downward progress on excessive diets of carbo-hydrate or protein. The one was in moderately good condition after three years. Dr. Allen found that the downward progress in these animals was purely the result of food injury. He was, however, not quite satisfied with the safety of either dog, since the dogs showed a slightly raised plasma sugar content. In a footnote, written at a later date, he records the death of both dogs, the one certainly from acidosis and the other probably from the same cause.

Hofmeister has shown that glycosuria can be produced by malnutrition or starvation. Dr. Allen endeavours to prove that this glycosuria is transitory and does not lead to true diabetes. He sought to utilize the mechanism of this so-called "hunger glycosuria" to increase the tendency to glycosuria in his diabetic dogs. He suggests that when a dog on the border line of diabetes refuses to eat enough to keep up the glycosuria, it might be advisable to allow it to fast for a time, in the hope that the glycosuria would be increased by the fast and, at the same time, the dog would again be induced to eat enough after the fast to reproduce the diabetic condition. In the next place, he studied the increase in tolerance in those dogs whose glycosuria was readily removed by prolonged underfeeding. He found that it was possible to increase the amount of carbo-hydrate and protein to some extent in these animals without damaging the powers of assimilation and without inflicting any destructive changes in the islands of Langerhans. But this success in raising tolerance was not invariably attained. He records the life histories of dogs in whom inflammatory changes in the pancreatic remnant led to an inability to assimilate food. The dogs died within a short time from inanition. In one instance slight hydropic changes were found in the islands of Langerhans, while in another the remnants appeared to be quite normal. In other experiments he met with conditions very similar to those seen in human diabetic patients. The diet was forced to the limit of tolerance, but occasional lapses, represented in the experiments by tolerance tests, called forth a return of the glycosuria. In these cases there was a steady downward tendency. In another dog a typical mild diabetes was induced by the removal of about eight-ninths of the pancreas. The dog was gluttonous and its carbo-hydrate excesses converted the mild diabetes into a severe one. The treatment adopted was to give a diet containing sufficient protein and fat to maintain the highest possible weight and strength. The weight and strength were maintained for a longer period than would have been the case had the glycosuria been induced. But the downward progress was nevertheless inevitable.

Dr. Allen gives further details of his experimental studies. These details are highly instructive and offer many important starting points for further investigation. He claims as a result of this portion of his work that the diabetes induced in dogs by the removal of part of the pancreas and by the overfeeding with carbo-hydrate or protein, or both, after the operation is similar in all respects to human diabetes. The similarity can be admitted, but his own records reveal some essential differences. The tendency to spontaneous increase of pancreatic activity by hypertrophy of the remnant has no counterpart in human diabetes. Even when diabetes is the result of a frank pancreatitis, the organ after the inflammatory process has become arrested is a damaged organ and does not reveal any tendency toward compensatory repair. There is ample pathological evidence of a progression of the degenerative changes as a result of the contraction of the cicatricial tissue. Again Dr. Allen claims that, in the absence of a progressive pancreatitis, his dogs showed no inherent downward tendency in their assimilation. He quotes the fact that one of his dogs lived for three years with known diabetes. He omits to mention that at the end of the three years this animal died of diabetic acidosis. It lived in a state of under-nutrition for a long time, but the fact that its urine did not contain sugar during the greater part of this period must not be interpreted that the diabetic condition was overcome. Medical practitioners too often have experience of patients whom they render sugar-free and yet an attack of pneumonia ends the story. These patients appear to be especially prone to intercurrent infective processes and to succumb to these infections more readily than normal persons. It would be interesting to ascertain whether the under-nutrition incident to Dr. Allen's starvation treatment does or does not influence this susceptibility to infections and to a fatal issue of them. Lastly, Dr. Allen emphasizes his opinion that the downward tendency in his dogs is the result of an intake of excessive quantities of carbo-hydrate or of protein. Surely in human diabetes the primary disturbance of the pancreatic, thyreoid or other glandular function is the essence of the disease and not the mere fact that the body fails to metabolize the carbo-hydrates and proteins. Hyperglycæmia and glycosuria are valuable indicators of the degree of metabolic disturbance, but by reducing the amount of sugar in the blood and in the urine, by restricting the material from which this sugar is formed, the practitioner does not actually influence the course of the disease.

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Abstracts from Current Medical Literature.

ORTHOPÆDIC SURGERY.

(9) Repair of Peripheral Nerve Injuries.

G. Carl Huber records the results of 21 series of experiments upon animal nerves (*Surg., Gynec. and Obstet.*, May, 1920). In the earlier part of the work Dean Lewis and the author examined methods for obviating the formation of the amputation neuroma. In this series there were 37 experiments. The sciatic nerve of rabbits was exposed, injected with absolute alcohol and divided from 5 to 8 millimetres from the point of injection, sometimes with excision of a segment of the distal portion. In all the experiments extending over a period of more than 3 weeks, the peripheral stumps maintained a formation with a sharp point and with no evidence of a neuroma. In a number which were examined histologically a down-growth of neuraxes was observed into the alcohol-injected field in the 5th week after operation. But these neuraxes had a regular course and did not exhibit the formation of a neuroma. In 21 control experiments an amputation neuroma developed in every one kept longer than 15 days. In another series of control experiments, 12 in number, injection of alcohol without subsequent severance of the nerve was carried out. In each case paralysis followed, but later the down-growing neuraxes were observed in the distal part of the nerve. This means that peripheral regeneration had occurred. Nerve transplantation was the subject of the greater number of experiments. In one series of 17 experiments the sciatic nerve of the dog was exsected for nearly 3 centimetres and the gap was bridged by an autotransplant from the cutaneous radial nerve of the opposite side. The conditions in this experiment were similar to those met in practical surgery, owing to the disparity in the size of the transplant and of the resected nerve. This disparity was met in 6 experiments by suturing 4 segments of the transplanted radial nerve. The author calls this a cable auto-nerve transplant. Observations were made on these four animals 11 days to 382 days after operation. In the experiments of longer duration neuraxes reached the distal part of the divided nerve with ultimate recovery as tested functionally and microscopically. In 6 experiments homologous nerve transplants were taken from one rabbit to bridge the gap in the sciatic of another. In these down-growing neuraxes could be seen in the section of nerve beyond the graft. Heterologous nerve transplants were used in 39 experiments. The results were less certain and less satisfactory and required longer time than when autologous or homologous transplants were used. In many of the series it was seen that many of the down-growing neuraxes passed outside the transplant, which appeared to act as a guide. Degenerated nerves were found to be satisfactory when used as homologous nerve transplants; but a degenerated heterologous nerve transplant was found to be less serviceable than a non-degenerated nerve. Nerves which were stored in vaseline for two weeks made quite satisfactory homologous nerve transplants. Storing in 50% alcohol did not prevent homologous nerve transplants from being successful. Cargile membrane placed round the suture line disappeared in a few days, but alcoholized cargile membrane was not absorbed within a period of five to six months. Nerves wrapped in an autologous facial sheath regenerated; but there was an increase in connective tissue growth within and without the sheath. Regeneration of nerve can take place through a prepared arterial tube, but the results are less favourable than when autologous or homologous nerve transplants are used.

(10) The Crucial Ligament of the Knee Joint.

Ernest W. Hey Groves (*Brit. Journ. Surg.*, April, 1920) records observations on 13 cases of rupture of the crucial ligament of the knee joint. He lays great stress upon the recognition of the obliquity of the ligaments. This can only be by an unobstructed view and consequently the author advocates free exposure of the joint by cutting through the tubercle of the tibia and reflecting the anterior part of the joint capsule upwards. In no case did the joint become infected with this exposure. In repairing the anterior crucial ligament the lateral condyle of the femur is drilled so as to have the inner end of the drill hole as far back on the lateral aspect of the intercondylar notch as possible. The anterior part of the tibia is then drilled in a similar way, so that the inner end of the hole lies just in front of the tibial spine. The external end of the drill hole lies over the most prominent part of the inner tuberosity of the tibia. A strip of gauze is stitched to a portion of fascia lata measuring about 20 cm. by 3.75 cm. wide and the latter is drawn through the tunnel. This strip is made from part of the ilio-tibial tract and the lower end remains attached to the tibia. The posterior crucial ligament is replaced by the tendons of the *semi-tendinosus* and *gracilis* which are freed for 15 cm. from their attachment to the tibia and drawn through the inner part of the posterior ligament of the knee joint until their free ends hang out from the front of the joint. A hole is then drilled through the medial condyle of the femur through which the new ligaments are drawn tightly with the knee in the extended position. The free ends are attached to the inner tuberosity of the tibia. The patients are allowed to walk in 6 weeks, but a moulded casing is worn for three or six months. Fourteen patients underwent operation; none were made worse; four showed no benefit, including two in whom both crucial ligaments were torn; four were benefited to some degree; four were cured and two patients were under treatment too recent to be discussed.

(11) Habitual Dislocation of the Shoulder Joint.

The deltoid muscle flap offers the best means of overcoming the tendency to dislocation, because it provides, firstly, a good sling, bracing up the head and neck of the humerus, and, secondly, a muscular sling which contracts when the rest of the deltoid is in action, that is in abduction in which position dislocation occurs. R. Otterenshaw (*Journ. Orthop. Surg.*, May, 1920) has performed the operation on four occasions. An anterior incision exposes the deltoid and after the muscle has been split the quadrilaterial space is cleared and enlarged. Through a posterior incision a flap of the deltoid is made and this is split from the rest of the muscle down to the periosteal attachment to insure sufficient length. This flap is then drawn forwards and stitched to the tendon of the *subscapularis* muscle. The author did not allow any of the patients to abduct the shoulder more than 60% until one month after the operation. At the end of two months full range should be reached. There was at the time of writing no recurrence of dislocation in any of the patients who had undergone operations in the previous year.

(12) Irreducible Paralytic Dislocation of the Hip Joint.

Ellis Jones reports a case of a male, aged 18 years, who had been paralysed at 18 months (*Journ. Orthop. Surg.*, April, 1920). The trochanter was 10 cm. above Nélaton's line. The thigh was flexed and adducted with 23 cm. of apparent shortening. X-ray examination revealed malformation of the femoral head, practically no acetabulum and marked atrophy of the femur and pelvic bones. The patient was placed on a Hawley table and direct skeletal traction was made through a Steinmann's pin inserted above the condyles of the femur. Flexion and adduction were first corrected by tenotomy after which the hip joint was opened. After the head of the femur had been remoulded a 10 cm. curved lip of bone was turned down as in Albee's operation. Two wedges of bone cut from the tibia were inserted above and behind this newly formed acetabulum roof. The traction pins were removed after closure of the wound and the limb put up in plaster, extending from the nipples to the toes in 30% abduction. This was removed after 16 weeks. Two years later the patient was able to enter an agricultural college and work a tractor.

MORPHOLOGY.

(13) Reformation of the Crystalline Style in Molluscs.

The significance of this peculiar organ present in certain molluscs has been a matter of conjecture for more than two hundred years, but in the past 38 years the long list of hypo-

theses regarding the value of the crystalline style to those molluscs possessing it has been, by a gradual process of elimination, reduced to three. Of these the "reserve food" hypothesis was put forward about 1890, but has since been proved untenable. A later theory was that its function is to furnish mucus for the coating of sand grain and other foreign bodies in the stomach, thereby preventing injury to the epithelium of the digestive tube as they pass through. The weight of authority since 1900 is that this organ functionates as a digestive ferment. During its rotation the style is gradually worn away against the gastric shield of the wall of the stomach and assisted by the movements of the cilia of the stomach wall, separates the refuse matter from the food, twisting the latter up at the end of the dissolving style, where it may be readily acted upon by starch-converting enzymes released from the style. This organ is necessary for the life and continued well-being of the mollusc and, although much work has been done as to the formation and function of the style in molluscs, where there is an incomplete separation of the intestine from the caecum in which the style rests, in none of the reports has the formation of the style been described in those cases where the style sac is completely or almost completely separated from the intestinal tract. Working on the theory that the reformation of the crystalline style, after extraction from the body of the molluscs, would take place in a normal manner if the animal were kept under normal conditions, it was decided to select a species, to remove the style and by examination at more or less regular intervals to follow the formation and development of the crystalline style in this particular species. *Mya arenaria* (the eastern long-neck class) was selected for the experiment, as being the best adapted of the bivalves easily obtainable. Approximately 50% of the individuals survived the extraction of the crystalline style by a severance of the style sac. A new style is completely reformed in the proximal portion of the sac in a period of about 74 days, when conditions are most favourable. At the end of the fourth day after operation the beginning of a new style may be observed, consisting of a delicate sheath of mucus enclosing a core of food material and lying on one of the typhlosoles. Its growth progresses more rapidly in the summer than in the winter months. The style is reformed in the short proximal portion of the sac, which is entirely separated from the distal portion by the operation. This proves conclusively that the epithelium of the style sac is the source of the crystalline style. An axillary food core is usually present in the early stages of the reformation of the style, but disappears with the complete development of the organ by the gradual movement of the latter into the stomach. After removal of the style *Mya arenaria* may exist for more than 30 days without ingesting food. The ingestion and digestion of food is apparently dependent on the degree of development of the style, since not until the organ reaches a state of sufficient maturity to be projected into the stomach, does the ingestion of food occur. (C. H. Edmondson, *Journ. Exper. Zoology*, April 5, 1920.)

(14) Experimental Degeneration in the Testis of the Dog.

A. Kuntz has studied the histology of degeneration of the testis of the dog (*Anatom. Record*, December 20, 1919). He took eight healthy dogs; in the first four of these (Nos. 1 to 4), under general anæsthesia, the inferior mesenteric ganglia and the sympathetic nerves, descending along the right spermatic artery, were removed as completely as possible without injury to the vessel. Nos. 3 and 4 also had the left testis removed at the time of operation; they were then prepared for examination of the normal condition. From 21 to 28 days later at autopsy the only gross macroscopical changes observable were congested blood vessels in the spermatic cords and testes. In all four on microscopical examination, marked degeneration of the seminal epithelium was found. In Nos. 1 and 2 this degeneration was equally marked on both sides; but in Nos. 3 and 4 degeneration was definitely less advanced in the right testis (which alone had been left *in situ*), and there was no apparent hypertrophy of the interstitial tissue. In the remaining four (Nos. 5 to 8) the right *ductus deferens* was ligatured and a portion resected; in Nos. 5 and 6, by an abdominal incision, under general anæsthesia and local anæsthesia respectively; in Nos. 7 and 8, by a superficial incision just proximal to the scrotum. They were killed 20 to 30 days later. No gross changes were observed in the testes. The seminal epithelium of the right testis was degenerated with marked hypertrophy of the interstitial secretory tissue and the left testis showed very similar but slightly less advanced changes. The degeneration in the first group (nerve resected) was of a definitely different type to that in the second group (cord resected). Nervous degeneration, as the first may be called, resembles that caused by exposure of the testis to X-rays (Bergonie and Tribondeau) or by a diet deficient in water soluble vitamine (Allen), etc. Hypertrophy of the interstitial secretory tissue is probably rather an accompaniment of degeneration of the seminal epithelium than a compensatory process due to the removal of one of the testes.

(15) Some Abnormalities of the Vertebral Artery.

Miguel Canizares (*Philippine Journ. Science*, November, 1919) has studied the anatomy of the vertebral artery in 40 cadavers. He deals with the abnormal origin of the vertebral artery and the variation in the exact costo-transverse (vertebrarterial) foramen of the cervical vertebræ which the vertebral artery enters. He found in two cases the left vertebral artery arising from the aortic arch between the left common carotid and the left subclavian arteries. In fifteen cases, including the above two, he found abnormalities of the second type. In six cases there was a bilateral entrance into the fourth, fifth and seventh (four cases) costo-transverse foramina. In the remaining nine cases a unilateral variation was noted, entering variously the third to the seventh foramen, the opposite side being normal in six cases. In eight cases the entrance had migrated cranially, the most striking being the cases in which the artery entered the third left costo-transverse foramen. In this case also the left artery arose direct from the aortic arch. The left side exhibited a greater tendency to cranial migration than the right. The author ascribes the high frequency of variations, 37.5%, to the fact that hybrids tend toward variation. Filipinos undoubtedly must be considered a mixed race. He also devotes considerable attention to the various possible embryological explanations of origin. They involve (*i.*) persistence of the primitive dorsal aorta and the main trunk of the sixth (or a more cephalic trunk) dorsal intersegmental artery, or (*ii.*) persistence of the second left aortic arch as part of the internal carotid stem, the third left arch forming part of the trunk of the vertebral artery, or (*iii.*) persistence of the sixth dorsal intersegmental artery alone, which would be possible if the sixth dorsal intersegmental artery arose primitively at the same level as the fourth aortic arch.

(16) The Parathyroid Gland of Thyroidless Bufo Larvæ.

Many of the earlier experiments upon the relationship between thyroid and parathyroid glands have been carried out upon mammals and in the removal of the thyroid the internal parathyroids have been simultaneously extirpated. The resulting enlargement of the lateral parathyroids might be attributed to the absence of the internal parathyroids, in part at least. The work of Bennet M. Allen is free from this objection, because the operation of removing the thyroid gland from anurian larvæ in no wise affects the parathyroids (*Journ. Exper. Zoology*, February 20, 1920). In these experiments the tadpoles failed to metamorphose as is usual. After living varying periods beyond the time of usual metamorphosis and having reached gigantic size, they were killed and the region of thyroid and parathyroid glands was examined. In anurans the parathyroids are four in number and quite distinct from the thyroid. It was found that there is a very marked hypertrophy of the parathyroids after removal of the thyroid gland, so that they grow to many times the normal volume. There is no deposition of colloid, nor any other evidence of the assumption of a vicarious relationship between the thyroid and parathyroid glands. There are, in fact, no noticeable histological peculiarities of the parathyroid glands resulting from removal of the thyroid gland.

British Medical Association News.

SCIENTIFIC.

A meeting of the Victorian Branch was held at the Medical Society Hall, East Melbourne, on June 2, 1920, Mr. G. A. Syme, the President, in the chair.

Mr. Alan Newton read a paper on the surgery of the spinal cord (see page 30).

Mr. Victor Hurley, C.M.G., in opening the discussion, said that Mr. Newton's excellent paper had covered practically all the special knowledge of spinal cord injuries gained during the war. Mr. Newton had been the first to demonstrate experimentally that the signs of "spinal concussion" could be produced in animals and were associated with definite microscopical lesions in the spinal cord. This work had been confirmed clinically. Observations on wounded men had also shown that a similar condition resulted in the case of peripheral nerves. Many instances had been noted where the track of a missile had passed in close proximity to a nerve, or even 1.25 cm. to 1.75 cm. from it, and yet there resulted the signs and symptoms of varying degrees of loss of function of this nerve peripheral to the wound. In these cases signs of recovery appeared much more quickly than was possible where an anatomical lesion of the nerve was present.

As showing the damage which could be inflicted on the cord by a missile which did not even penetrate the spinal dura, Mr. Hurley instanced a case of his with a through-and-through wound of the neck and all the signs and symptoms of complete loss of function below. From the position of the wounds it seemed improbable that the path of the missile had traversed the spinal canal. Post-mortem examination revealed the fact that the body of the 5th cervical vertebra had been shattered, but the spinal canal and *dura mater* were intact. On opening the dura, the spinal cord, to outward inspection, appeared uninjured, but on incising the cord there was found an extensive hæmatomyelia of maximum intensity in the lower cervical region, spreading upwards and downwards in the grey matter.

With reference to the indications for operation in injuries of the spinal cord, Mr. Hurley was in agreement with Mr. Newton that improvement after operation was only to be expected in those cases of incomplete lesion of the cord in which, after the initial apparently complete lesion, some recovery took place and then the condition remained stationary. In such cases the removal of foreign bodies or bone fragments was frequently followed by still further improvement.

Regarding the possibility of repair of injuries of the *cauda equina*, he was rather doubtful. While it was, of course, desirable to do so, it was rarely possible to identify the corresponding divided ends and to perform suture.

In the case of the bladder, Mr. Hurley favoured regular and scrupulous catheterization. Many surgeons had adopted the supra-pubic cystotomy recommended by Thomson-Walker, but in his experience, although the bladder opening remained water-tight for a few days, leakage beside the tube occurred and the patient suffered from all the discomfort of a urinary fistula.

Sir Henry Maudsley, C.M.G., C.B.E., related how surprised he had been upon one occasion at King George's Hospital, to find in a soldier with a complete transverse cord lesion sequent on a gun-shot wound of the mid-thoracic spine that the reflexes below the lesion were present and of the type seen in the spinal animal; in fact, the patient was virtually a "spinal man." He had formerly accepted and had based his teaching upon the views of Bastian (in some of whose observations he had been privileged to take a part) that flaccid paralysis with abolition of reflexes supervened below the level of a complete lesion of the cord and that below this level the cord could do nothing. In the patient to whom he had referred, the bladder was emptying automatically, reflexes were present and there were no bed-sores; yet in this man it had been shown that there was a distance of from 5 to 7.5 cm. between the divided ends of the cord. The very good condition in which he found this soldier had impressed him as remarkable. Several days later he saw an officer at Wimbledon in very much the same condition, looking well, with his bladder emptying regularly and automatically. Flexor spasms occurred in the lower limbs, but he wished to emphasize the fact that three years had elapsed since this officer had sustained the wound implicating the cord in a complete lesion.

Sir Henry remarked that cases such as he had quoted, indicated the fundamental importance of the care of the bladder; the two instances he had outlined were managed by the first of the methods given by Mr. Newton—regular catheterization every 6 to 8 hours in the early stages. He had seen in London many examples of automatic bladder acting well. If scrupulous care were taken from the outset, cystitis, if it should occur, would be mild and amenable to treatment.

It was essential that any condition capable of producing toxæmia should be earnestly combated, for if cystitis occurred, the spinal cord functions were lost. It was wise to avoid even the administration of an anæsthetic if it were at all possible.

The subject under discussion carried them back to the work of Walsh before the war on paraplegia and still further back to Sherrington's classical researches on the "spinal" and the "de-cerebrate" animal. The lesson to be drawn was one of hopefulness. They should not despair of these cases formerly regarded as hopeless, but should make every endeavour by the exercise of scrupulous cleanliness to attain results such as he had been privileged to see and had endeavoured to describe. It was not inconceivable that patients who had attained the degree of recovery he had indicated, would be capable of procreation.

In conclusion, Sir Henry Maudsley complimented Mr. Newton on his very valuable paper.

Dr. S. V. Sewell expressed his keen appreciation of Mr. Newton's able presentation of the subject. He pointed out that the experimental work of scientific physiologists, especially Sherrington, had received remarkable confirmation from neurologists generally, as the result of their observations on cases of spinal cord injury during the war. The speaker, as neurologist to the Base Hospital, St. Kilda Road, had had opportunity of observing many cases of spinal cord injury. He found himself in complete accord with the views put forward by Riddoch and by Walsh. The old discussion regarding the results of transverse lesions of the spinal cord had been finalized in a manner quite different from that which the majority of neurologists had anticipated. Bastian's view of the conditions indicative of a complete transverse lesion had been generally accepted and seemed to fit in with the result of experimental transsection of the spinal cord in animals. Observations of this kind had demonstrated an ever increasing dominance of the head segments as they ascended the animal scale. Whereas hypertonicity of the musculature below the level of the lesion was observed in lower animals, hypotonicity was invariably present in the higher apes. It seemed natural therefore that a further dominance of head segments should exist in human beings, resulting in complete flaccidity with loss of reflexes below the level of the lesion. This view had been modified in accordance with the conclusive work of Riddoch, Head and other observers. As indicated by Sir Henry Maudsley, it had been demonstrated beyond question that after the initial shock had passed, complete transsection of the human spinal cord was associated with various manifestations of more or less complete reflex activity below the level of the lesion. It was of interest to note how accurately Sherrington's work on the spinal animal had been reproduced in human beings. The principal problem was to distinguish, after the initial shock had passed, between complete and incomplete lesions of the cord. The type of reflexes observed in complete lesions differed from that obtaining in incomplete lesions. In the former reflex activity was shown almost exclusively in the flexor muscles. In the latter the picture approximated that of the decerebrate animal in which anterior reflexes and ultimately hypertonicity of the extensors prevailed. In incomplete lesions of the cord there was only a partial interruption of the proprio-spinal paths and of the thalamo-rubral and vestibulo-spinal tracts which had been demonstrated to be very resistant to pressure and other damage. The result of reflex stimulation of the sole of the foot might be taken as an illustration. In complete lesions the flexor response obtained might overflow to the opposite limb, in which event

it seldom, if ever, spread to the extensor muscles, or in other words, a progression reflex could not be induced. On the other hand in partial cord lesions the overflow to the opposite limb usually embraced the extensor muscles and resulted in definite progression movements. In complete lesions of the cord the atonicity of the extensor muscles led to a quick jerky flexion reflex, very different from the more deliberate postural movements obtained in cases of incomplete lesions. A high degree of spasticity below the lesion was strongly in favour of complete transsection of the cord.

In the course of some remarks relating to the innervation of the bladder, Dr. Sewell mentioned the teaching that a centre for reflex micturition existed outside the central nervous system. Axial and ganglion reflexes occurred even if the sacral spinal cord and the *cauda equina* were destroyed. He owned that he had considerable difficulty in reconciling this view with his clinical observations. He instanced one case of a man he had shown at a meeting of the Branch some years previously. The man stooping over his work had been struck on the back and doubled forward by a falling tree. He sustained a fracture-dislocation of the third and fourth lumbar vertebræ. He was subsequently found to exhibit complete loss of sensation over the fifth lumbar and all the sacral segments with paralysis of the corresponding muscles. This man had complete retention of urine from the time of the accident and emptied his bladder regularly three times a day by catheter. Dr. Sewell had seen this patient at intervals for a period of ten years after the accident. Only on one occasion had there been an overflow incontinence. The capacity of this man's bladder was upwards of 250 c.cm.. This was therefore a pure *cauda equina* lesion. He had notes of similar cases in which the detrusor mechanism was out of action, but the lumbar influence by way of the hypogastric mechanism was presumably intact.

Dr. C. Gordon Shaw, D.S.O., joined with the preceding speakers in their expressions of thanks to Mr. Newton. He had been very much impressed by the first case he had seen of undoubted complete transverse lesion of the cord, in which the reflexes returned and regular automatic emptying of the bladder was established. In that case he had observed the overflow of the flexor reflex in the great toe to the other side. It followed that every effort should be made to attain the maximum degree of recovery in injuries of the spinal cord. A great deal might be accomplished by re-education in spinal men; better degrees of recovery would follow systematic efforts at re-education.

As regards the indications for operation in spinal injuries, Dr. Shaw was of opinion that no patient should be subjected to immediate operation. The wiser course was to wait and see what degree of recovery would ensue. It was not always easy to differentiate between pure concussion, partial division and complete division. Moreover, it was often surprising to observe how much improvement would occur.

Dr. Shaw emphasized the importance of complete rest in the management of these cases. The probability of fracture of the spinal column should not be overlooked and therefore immobilization should be secured. For this purpose he had often utilized plaster jackets.

With reference to operations upon divided nerve trunks in the *cauda equina*, he felt bound to say that he had not succeeded in uniting the severed nerves by suture although he had frequently removed foreign bodies. Suture was recommended in text-books, apparently without regard to the practical obstacles raised by the depth of the wound, the confined space of the field of operation and the difficulty of bringing the proximal and distal ends together. As Mr. Hurley had pointed out, it was almost impossible to identify the correct nerves to suture. Altogether, he was rather sceptical about the utility of operations upon injuries of of the *cauda equina*, except those of a simple nature, such as the removal of a foreign body, or of callus and scar tissue.

Dr. Shaw had no wish to be dogmatic in discussing the merits of the various methods for the care of the bladder described by Mr. Newton, but he personally favoured regular catheterization with irrigation as the indication arose. The passage of a catheter three or four times a day, with perhaps one or two irrigations of the bladder, might not be always practicable in war time, when large numbers of patients required attention. Perhaps under such circumstances the method of supra-pubic cystotomy would be more satisfactory. Cystitis was eminently preventible and the milder degrees could be cleaned up by bladder irrigation.

Dr. Shaw stated that he had had no experience of the operative technique of laminectomy described by Mr. Newton, but it appealed to him as a very convenient mode of procedure.

Mr. Alan Newton, in reply, said that possibly he had spoken too hopefully regarding suture of divided nerves in the *cauda equina*. He had not intended to underestimate the difficulties of the operation, but wished to convey that it should be performed whenever possible. If a difficulty arose in the identification of the correct proximal nerve trunk to which the distal portion should be united, he would have no hesitation in joining it to the nearest and most convenient, rather than not to suture it at all.

He thanked the members of the Branch for the attention they had accorded his paper.

MEDICO-POLITICAL.

A special meeting of the Queensland Branch was held at the B.M.A. Rooms, Adelaide Street, Brisbane, on June 18, 1920, Sir David Hardie, the President, in the chair. The meeting had been convened to consider the attitude of the Queensland Branch of the British Medical Association toward the referendum to be taken on the liquor question.

The President explained that a referendum would be taken in October, 1920, on the question of the advisability of regulating or prohibiting the sale of alcoholic beverages.

Dr. A. H. Marks, C.M.G., D.S.O., opened the discussion. He said that he had enjoyed a glass of wine or an iced "lager" in summer time and heartily agreed with the verse from *Ecclesiasticus* that "wine measurably drunk and in season bringeth gladness to the heart and cheerfulness of mind." He had held the opinion until the last few years that prohibition or any other drastic interference was wrong. During recent years, he had travelled a long distance and had seen large numbers of men congregated together and working under peculiar circumstances of stress and strain. He had had command of and responsibility for varying numbers of men. On returning home to a country where the old liquor acts were still in action, he had noted more drunkenness and the results of drunkenness than in Egypt, England, Ireland or South Africa. He had been so impressed by this experience that, although he still liked his "spot," his vote would go for prohibition.

The idea of the meeting was to place clearly before the members of the Branch the issues on which they would be called on to vote in October, to discuss the matter and to give the public some expression of opinion from the medical profession.

The *Liquor Act* of 1920 provided for a referendum every three years. The first was to be held in October, 1920, and the vote would be taken on three issues. It was important to have a clear understanding of these questions, so as to get rid of side issues. They were as follows:—

(*i.*) State management of manufacture, importation and sale of fermented and spiritous liquors.

(*ii.*) Prohibition of manufacture and importation and retail of fermented and spiritous liquors, to take effect in 1925.

(*iii.*) Continuance of the present system.

They would see from the three proposals that early closing was not included, unless it were introduced under State control. Prohibition, if passed, would not take effect until 1925. The *Liquor Act* of 1912 guaranteed this to the trade in lieu of compensation.

He did not think that any rational person, much less a medical practitioner, who saw so much loafing and drunkenness in the streets and who knew how much sickness and want was caused by alcohol at present, could agree that the present system was satisfactory. The majority would therefore agree that some change should take place. The choice was therefore narrowed to the two remaining proposals. He had found it difficult to obtain details concerning State control. The general impression was that it would not be satisfactory. As far as he had been able to find out, the

local control at Babinda had made no difference in the frequency of drunkenness. The scenes at the State bar at the Central Station were as bad, if not worse, than at other hotels in the city. In the Northern Territory the State hotels had not been an unqualified success. Russia had instituted some years before the war a State control with the intention of lessening the general drunkenness. The State control had led to a monopoly and the trade had been run as a source of income. There were but two States, as far as he was aware, where State control had been tried on a dispensary system; prohibition had followed in both cases as a result of a referendum. The first was Saskatchawan and the second South Carolina.

Turning to the question of prohibition Dr. Marks dealt with the objections that had been raised. In the first place it was said to interfere with the liberty of the subject. The same might be said about the sale of opium or similar drugs, or, indeed, about the application of the Health Acts and the Quarantine Acts. In the second place, it was said that prohibition was unworkable and that it had not been tried long enough to prove its advantage. He wished to reply that it had acted very well among the people of the Mohamedan religion, for though he believed that Mohamedans did not hold strictly to the law, the general populace did, and certainly there was scarcely any drunkenness to be seen in Egypt. Prohibition had been tried in some of the American States for many years. In the State of Maine a law had been passed in 1846 prohibiting the sale of alcohol except for medicinal and industrial purposes. The importation of quantities not less than 28 gallons had been allowed. In 1851 a strict prohibition law had been passed. This had been repealed in 1856 and the State returned to the licence system. In 1858 the law was re-enacted, subject to a referendum. The act had been endorsed by a popular vote of 28,864 to 5,912. In 1884 an amendment had been submitted to referendum and was passed by 70,783 to 23,811. In the State of Kansas prohibition had been introduced in 1881 and the State had been "dry" ever since. These two instances proved that prohibition was possible, even in an Anglo-Saxon community.

The third objection was that there would be an increase in illicit liquor trading and also in drug taking. He admitted that the increase in illicit liquor trading would naturally result, but this could be kept down by law. He thought that the second objection was doubtful and further that if this did occur, it could also be controlled by legislation.

In conclusion Dr. Marks stated that in his opinion continuance under the present conditions was impossible. State control, like all socialistic ideals, was perfect as an ideal, but far too doubtful a blessing as a reality. Prohibition, though cutting the individual off from some of his pleasures, would be a gain to the State and was a workable condition.

Dr. Kerr Scott said that the members of the medical profession exerted a strong influence on the community in matters connected with the national health. In this knowledge they should practise self-denial and self-restraint. They knew the poverty, criminality and immorality that went hand in hand with drink. Alcohol reduced the will power and the moral tone of its devotees. The children of inebriates had a hard fight in life against the craving for alcohol. Apart from inheriting the craving, they were liable to be dragged down through the example of their parents. Alcoholism and vice were mates and disease followed in their train.

He referred to the poll that was to be taken in October in the State of Queensland regarding the sale of intoxicating liquors. He had no hesitation in choosing between State control and prohibition. Under State control the present state of affairs would continue and the general public would be no better. State control had been tried in various States in America, where later prohibition had been introduced. Prohibition had proved far more satisfactory. They in Brisbane had had a brief experience of prohibition during the general strike in 1912, when the hotel bars had been closed for a few days. During that time the admissions to the General Hospital had been greatly lessened, especially in regard to drunkards and their casualties.

For these reasons he strongly advocated prohibition. He wished to speak of some convincing facts. During the war the number of rejects in Australia amounted to something like 62%. In Great Britain the percentage was even greater. In the United States of America, the rejects represented 52%, ranging from 30% in New Jersey where there were no drink restrictions, to 32% in Kansas, a prohibition State. The population of the State of Kansas was three times that of Queensland. This State had had prohibition for 40 years. Not only did it have the smallest number of rejects in America, but its death-rate had been reduced to 7‰. Moreover, its public debt of over £300,000 had been wiped out. The effect of prohibition in Ontario had been to increase business; work had been done more effectively; the conditions of life had been improved; poverty and crime had been reduced; and the health of the community had been benefited. In America institutions for the alleviation of distress had been closed, as there was no longer any need for them.

Prohibition did not close hotels. It merely closed the bars. The effect of prohibition had been declared to have improved the accommodation at hotels. It had been stated that drug taking, particularly cocaine, would be the result of prohibition. The people of the prohibition States, such as Kansas and Ottawa, declared that there had been no increase in drug taking.

Dr. Kerr Scott expressed the hope that prohibition would restrict the indiscriminate sale of medicated wines, especially in the interests of innocent persons. He anticipated the argument that prohibition represented an interference with the liberty of the subject. No one objected to the right of the authorities to prohibit the sale of harmful articles, such as diseased meat. The sale of certain drugs and poisons was also restricted. Dr. Kerr Scott could not understand why restriction should not be placed on the sale of one of the greatest curses to mankind, intoxicating liquors.

Dr. Lilian Cooper endorsed the remarks of the previous speakers and dealt with the effects of alcoholic excesses on women.

Dr. W. F. Taylor, M.L.C., mentioned that some time ago the Roman Catholic hierarchy in Melbourne had considered that the moderate use of alcoholic beverages should not be deprecated. However, no middle course was offered in the referendum. Many people would wish to introduce a reduction in the strength of alcoholic beverages, such as ale to not more than 5% to 7%, wines to 10%, etc.. Dr. Taylor held that the present state of affairs should not continue. Under State control the hours of sale might be lessened, but the evil would persist and the position would be but little altered. Prohibition seemed to be harsh and an interference with the liberty of the subject. It had apparently acted well in those countries where it had been tried. It should therefore be given a trial in Queensland.

Dr. A. Stewart referred to the use of medicated wines and other so-called innocent remedies, which contained large amounts of alcohol.

Dr. J. Lockhart Gibson thought that it was better to vote for prohibition than to let it go on as at present. Prohibition would not stop the habitual drunkard who would get drink somehow. "Anti-shouting" legislation might do some good. Similarly State control might be beneficial, if the lighter percentages only were permitted. With the present trend towards more holidays, unless prohibition were carried, the average working man's family would get less and less for food.

Dr. A. Jefferis Turner held that alcohol had its uses in stimulating appetite and causing sleep. The community had to pay a heavy price for these benefits, a price that was too high. His opinion concerning prohibition had been altered by the war. The political power of the liquor trade was very great and the opportunity had now come to diminish it. Among those who could not resist the temptation of alcohol, were many of the finest members of the community. The only remedy for these men was prohibition. He was convinced that prohibition was practical. "Anti-shouting" laws were of dubious value. Early closing was good, because it was partial prohibition.

Dr. C. A. Thelander held the opinion that any measure which reduced the consumption of alcohol, was beneficial.

Dr. J. E. Streeter thought that the fact that some hotels under State control had proved failures, was merely evidence of bad administration of the present government. Prohibition was in his opinion too drastic a change. The trade should be placed on a proper footing and the hours of sale should be regulated. He considered that a ballot should be

taken before any expression of opinion of the Queensland Branch of the British Medical Association was published in the public press.

Dr. A. B. Brockway was strongly in favour of prohibition. He spoke of the delay of hospital ships at every port caused by drunken firemen and patients.

Dr. A. Graham Butler, D.S.O., resented that he was compelled to vote for prohibition at the present time. There was no scientific proof that alcohol was not beneficial, if properly used. The use of alcohol had been allowed to get into a position of misuse. The trade had a hold that would block State control. It had missed its opportunity and should now be put in its proper place. The only alternative, therefore, was prohibition.

Dr. A. C. Halford considered that the vested interests of the trade were so strong that unless they were wiped out by prohibition, legal enactment would be powerless to regulate the trade. If the producers could be forced to supply only pure beverages, no harm would result. But this was impossible and they were therefore faced with Hobson's choice—prohibition.

Dr. W. N. Robertson thought that the referendum would end in the continuance of the present state of affairs. As the ballot stood, they could only vote for prohibition.

Dr. A. Marks moved and Dr. Thelander seconded:—

> That the metropolitan members of the Queensland Branch of the British Medical Association at a special meeting called to consider the liquor referendum, endorse prohibition.

The motion was carried.

Dr. A. Jefferis Turner moved and Dr. J. Lockhart Gibson seconded a motion to the effect that this decision should be published in the daily press. Dr. A. C. Halford suggested that the resolution should not be published until a ballot of all the members had been taken. This proposal was not supported and Dr. Turner's motion was carried.

Dr. J. E. Streeter moved that a referendum of all the members of the Queensland Branch be taken and that the determination to apply the referendum be announced in the public press. The motion was seconded by Dr. A. Graham Butler and was carried.

The undermentioned have been nominated for election as members of the New South Wales Branch:—

Charles Owen Gregory Donovan, Esq., M.B., Ch.M., 1915, (Univ. Sydney), Waverley Street, Waverley.

William Edward John Paradice, Esq., M.B., Ch.M., 1920 (Univ. Sydney), Gordon Road, Chatswood.

Miss Adèle Lindesay Aitken, M.B., Ch.M., 1918 (Univ. Sydney), Sydney Hospital, Sydney.

FAREWELL DINNER TO PROFESSOR WILSON.

The seventh annual dinner of the University of Sydney Medical Society will be held at the Wentworth Hotel, Sydney, on Friday, July 23. This dinner will be a farewell dinner to Professor J. T. Wilson prior to his departure for Cambridge. Tickets may be obtained from Dr. J. Paling, Royal Prince Alfred Hospital, Dr. H. R. G. Poate, Dr. Howard Bullock or the Honorary Secretary, Mr. D. G. Radcliffe, at the Medical School. Tickets may also be obtained at the office of *The Medical Journal of Australia*. The cost of the tickets will be 16s. 6d. each. Medical practitioners, whether graduates of the Sydney University or not, are invited to attend, in order that a representative gathering may pay their respects to Professor Wilson. Early application for tickets will materially assist the committee.

THE ANDERSON STUART MEMORIAL FUND.

We have been asked to announce that a public meeting will be held in the Library of the New South Wales Branch, 30-34 Elizabeth Street, Sydney, on Wednesday, July 14, at 8.15 p.m., to inaugurate a fund in memory of the late Sir Thomas Anderson Stuart. It is proposed that the Anderson Stuart Memorial Fund shall provide a travelling fellowship and that the holders on their return to Sydney shall undertake to devote a given period to teaching within the University. Sir Herbert Maitland, Dr. Cecil Purser and Mr. M. Gearey are the joint Honorary Treasurers. The Honorary Secretaries are Dr. H. H. Schlink, Dr. J. Paling and Dr. J. Hunter.

University Intelligence.

THE UNIVERSITY OF SYDNEY.

A meeting of the Senate of the University of Sydney was held on June 28, 1920, at the University Chambers, Phillip Street, Sydney.

The Senate further considered the report of the Professorial Board in regard to the recommendations on the application of the McCaughey bequest. The following recommendations were adopted: Faculty of Arts (1) an Associate Professorship in German and Comparative Literature; Faculty of Science—Lectureship in Entomology. It was resolved that the conditions for filling the lectureship stand over for the consideration at the meeting of the Senate in August.

It was also resolved that the consideration of the suggestions as to the allocation of any accummulation from the McCaughey funds contained in the report of the Professorial Board stand over for the present.

Chair of Physiology.—On the recommendation of the Faculty of Medicine it was resolved that in future there be a Professor of Physiology in charge of the Department and, after filling that appointment, an Associate Professor of Physiology should also be appointed, who would be entrusted with the duties of teaching and research in that branch of the subject of physiology which does not represent the primary interest of the full professor. It was resolved that a committee be appointed to report upon the steps to be taken to fill the Chair of Physiology and the Associate Professorship, the Chair of Surgery and the Chair of Dentistry, such committee to consist of the Chancellor, the Vice-Chancellor, the Warden and the medical members of the Senate, Judge Backhouse and Mr. Leverrier.

It was also resolved that a committee be appointed to report upon the steps to be taken to fill the Chair of Electrical Engineering, such committee to consists of the Chancellor, the Vice-Chancellor, the Warden, Professor Warren, Dr. Purser, Mr. Bradfield, Mr. Nangle and Mr. Leverrier.

The recommendations contained in a report of the committee appointed by the Senate to report upon the steps to be taken to fill the chairs of English literature and English language and the chair with other appointments in French was adopted in the following amended form in regard to the chair of French and the chair of English literature.

Chair of French.—(1) That applications be invited by advertisement in Australasia and in the United Kingdom and France; and that a committee be appointed in England to report upon the applications received in the United Kingdom and France. Applications from Australian candidates may be forwarded to the University here or to the London

That the following constitute the committee:

The Agent General for New South Wales (Chairman and Convener).

Professor O. H. P. Prior, D. *et* L., Foch Professor of French, Oxford.

Professor C. Sarolea, K.O.L., Ph.D., D.Litt., Professor of French and Romance Philology in the University of Edinburgh.

Professor W. P. Ker, M.A. LL.D., D.Litt., Quain Professor of English, London; and Professor of Poetry, Oxford;

and that it be suggested to such committee that Dr. Siegfried might be able to give them information that would be valuable in connexion with French applicants.

Chair of English Literature.—(2) That applications be invited by advertisement in the United Kingdom and in Australasia; and that a committee be appointed to report upon the applications received in the United Kingdom. Applications for Australian candidates may be forwarded to the University here or to the London committee, or to both.

That the following constitute the committee:—

The Agent-General for New South Wales (Chairman and Convener),

Professor W. P. Ker, M.A., LL.D., D.Litt., Quain Professor of English, London; and Professor of Poetry, Oxford.

Professor O. Elton, M.A. D.Litt., King Alfred Professor of English Literature, Liverpool.

Professor W. M. Dixon, D.Litt, Regius Professor of English Language and Literature, Glasgow; or

Professor H. J. C. Grierson, M.A., LL.D., Regius Professor of Rhetoric and English Literature, Edinburgh.

The report of the committee in regard to the chair of English language was postponed for consideration till the July meeting of the Senate.

Letters were received appealing against the sentence of suspension for the remainder of the year passed by the Proctorial Board and confirmed by the Professorial Board on students for participation in improper conduct in the students' procession. The Warden read the minutes of the Proctorial Board and after discussion it was resolved that the appeals be dismissed and the action of the Proctorial Board upheld.

The following resolutions were passed:—

That the thanks of the Senate be transmitted to the Inspector-General of Police for his kindness in personally supervising the arrangements in connexion with the visit to the University of H.R.H. the Prince of Wales; also to Brigadier-General Mackay, Captain Allen, Captain Harper and Captain Cusbert and the returned University soldiers for their co-operation.

Mr. J. C. Windeyer, M.B., Ch.M., was appointed to the Lectureship in Obstetrics.

It has been announced that Dr. Isaac Jones, formerly Medical Tutor at Trinity College, Melbourne, has been appointed Assistant Professor in Medicine at St. Thomas's Hospital Medical School in London.

Congress Notes.

The date of the Australasian Medical Congress is August 23-28, 1920.

The official address of the Congress is: The Honorary Secretary, 11th Session, Australasian Medical Congress, B.M.A. Building, Adelaide Street, Brisbane.

The following are the Local Secretaries in the several States:—

***New South Wales*: Dr. F. Brown Craig, Macquarie Street, Sydney.**

***Victoria*: Dr. A. Leo Kenny, Collins Street, Melbourne.**

***South Australia*: Dr. F. S. Hone, North Terrace, Adelaide.**

***Western Australia*: Dr. W. Trethowan, 267 St. George's Terrace, Perth.**

***Tasmania*: Dr. E. Brettingham Moore, Macquarie Street, Hobart.**

***New Zealand*: Dr. C. E. A. Coldicutt, 82 Simonds Street, Auckland.**

***Queensland*: The Honorary General Secretary and the Coadjutor Secretary, c/o. Queensland Branch, British Medical Association, Adelaide Street, Brisbane.**

The following is a list of the Honorary Secretaries of the Sections:—

(i.) *Medicine*: Dr. Andrew Stewart, Wickham Terrace, Brisbane.

(ii.) *Surgery*: Dr. Donald A. Cameron, Wickham Terrace, Brisbane.

(iii.) *Obstetrics and Gynæcology*: Dr. Lillian V. Cooper, George Street, Brisbane.

(iv.) *Pathology and Bacteriology*: (In place of Dr. A. W. Dean) D. J. V. Duhig, Wickham Terrace, Brisbane, and Dr. A. Breinl, Institute of Tropical Medicine, Townsville.

(v.) *Public Health*: Dr. J. S. C. Elkington, Federal Quarantine Department, Brisbane.

(vi.) *Ophthalmology*: Dr. J. Lockhart Gibson, Wickham Terrace, Brisbane.

(vii.) *Otology, Rhinology and Laryngology*: Dr. W. N. Robertson, Wickham Terrace, Brisbane.

(viii.) *Diseases of Children*: Dr. A. Jefferis Turner, Wickham Terrace, Brisbane.

(ix.) *Naval and Military Medicine and Surgery*: Dr. G. P. Dixon, C.B.E., Wickham Terrace, Brisbane.

(x.) *Neurology and Psychological Medicine*: Dr. T. H. R. Mathewson, Brunswick Street, New Farm, Brisbane, and Dr. J. R. Nicoll, Hospital for Insane, Toowoomba.

(xi.) *Dermatology and Radiology*: Dr. V. McDowall, Preston House, Queen Street, Brisbane.

Travelling Concessions.

Arrangements have been made with the Railway Commissioners of New South Wales, Victoria, South Australia and Western Australia for the issue of tickets to members of Congress at two thirds of the ordinary fares. The condition governing these concession tickets is that at least six members must purchase tickets in each State. The wife of a member accompanying her husband may obtain railway tickets at the reduced rate. Wives, however, are not included in the minimum number necessary for the concession. The regulations provide that the journey undertaken on these concession tickets cannot be broken except at a capital city and then only for one night. The Railway Commissioners of South Australia have agreed to relax these restrictions and to permit a longer break in the case of members travelling from Western Australia. The New South Wales Railway Commissioners have refused to modify the regulations. The Commissioners of the Victorian Railways are being asked to adopt the same attitude as the Commissioners in South Australia. The Tasmanian and Queensland Railways offer tickets at half the usual rates to members of the Congress.

Section of Naval and Military Medicine and Surgery.

The Honorary Secretary of the Section of Naval and Military Medicine and Surgery has delayed the publication of the subjects chosen for special discussion, owing to the fact that the members joining the Section have been slow in announcing their intention to take part in these discussions.

Sectional Programmes.

The subjects selected for special discussion in the Sections of Medicine, of Surgery, of Pathology and Bacteriology, of Public Health and State Medicine, of Ophthalmology, of Otology and of Diseases of Children have been published during the past few weeks in the *Journal*. It is anticipated that the programmes of the Sections of Obstetrics and Gynæcology, of Neurology, of Naval and Military Medicine and Surgery and of Dermatology, Radiology and Medical Electricity will be published within a short time.

Correspondence.

THE OSLER MEMORIAL FUND.

Sir: The *Journal* is to be heartily congratulated on its public-spirited action in opening a subscription list for the fund to establish the Osler Institute of Preventive Medicine, and so giving the profession in Australia an opportunity of expressing in practical fashion its interest in imperial medicine and health and of repaying in some degree the great debt of gratitude we, as members of a noble profession, owe to this greatest teacher of our race in this generation.

The majority of the British moiety of medical practitioners have imbibed Osler when but puny nurslings on the breast of their own *Alma Mater*, whether in Australia or the British Isles.

As candidates for higher degrees or graduates in the wide sphere of general practice, this man, through his writings, was their guide, philosopher and friend—a friend in need and an ever-present help in time of trouble.

His text-book was the most successful of modern times, full of wisdom, framed in gems of literary expression, the best all-round product of British medicine. It has been translated into every language of culture, including Chinese. No

other physician has made, whether personally or by his pen, such a profound impression on his contemporaries throughout the world and Australians have been his most faithful disciples.

Certain facets of this brilliant character and phases of the project for perpetuating his memory should, I believe, especially recommend the memorial to members of the Australian Branches of the British Medical Association.

First, Osler, with his unique first-hand experience of every kind of practitioner and his whole-souled love for his profession, was always an out-and-out supporter of the general practitioner. In these days of a hundred and one specialities, ranging from radiology to psycho-analysis, or fixing every fragment of the body as its own, from club-foot to the ductless glands, it was refreshing and inspiring to hear him, in season and out of season, stoutly uphold the overwhelming importance of the general practitioner—"the salt of our profession; by him we stand or fall."

Secondly, Osler was the product of an overseas dominion. Though his name first came into world prominence in connexion with his work at the Johns Hopkins' at Baltimore, he was born, bred and trained in Canada. In returning later to England, as Regius Professor of Medicine at Oxford, he was but obeying the homing instinct of his race, for he was of true British stock.

He was very keen on dominion men and those of us who were so fortunate as to come under his wing, can testify to his deep personal interest in Australians. He considered himself as being *in loco parentis* to us and no parent could have been kinder, more thoughtful or more keenly interested in each individual's work and future. To my certain knowledge, he knew the names of the best men in every State of Australia and their special aptitudes and kept up a constant intimate knowledge of our journal, congress reports and literature.

Thirdly, it may not be realized, but this Institute of Preventive Medicine will be of direct benefit to Australians. Between 1904 and 1914 Australian Rhodes Scholars supplied a large proportion of scientific researchers in Oxford, especially on the medical side (physiology, pathology, etc.).

Seven or more scholars go every year to Oxford and those who enter for medicine will almost certainly study for some of their time at this great institute, so that as much, if not more than any other part of the Empire, Australia should benefit by the high standard of experience and work which will most surely result from this splendidly conceived project.

Surely, with this benefit to be derived, it should be a privilege for those of us who believe in Australia and in the future of preventive medicine and scientific research, to contribute what we can to the foundation of such a great and beneficial and practical memorial to such a great, beneficent and practical representative of our profession and our race.

Yours, etc.,

HARVEY SUTTON.

Department of Education, New South Wales, Medical Branch, Sydney,
July 1, 1920.

PAYING HOSPITALS.

Sir: I beg to endorse the remarks of "Medical Staff" on this important subject. Being for a number of years connected with one of the hospitals in Melbourne, I can testify to the growing abuse of the hospital system till now one can hardly feel that their work in the main is the work of charity. This particularly applies to out-patient departments and to cases of small operations where admission to a ward for two or three days is all that is required. In these days of high wages for men and women there are very few who cannot pay a moderate fee for two or three consultations and even for operations which do not require a private hospital for any length of time. As a matter of fact the public hospitals have come to realize this and in many cases get fees from patients which would satisfy most members of the profession who are not blessed with a wealthy *clientèle*. And so these members of the profession not only do the charity work of the hospital, but have their services hired out to people not in need of charity, whose fees largely pay for the running of the hospital. Such arrangement would have been right and proper in days long past, when hospitals were run by religious orders and staffed by members of those orders. It was then the paramount duty of the orders to provide for the hospital staffs. But under present conditions the position is illogical and in view of the high cost of living and higher taxation the profession must deal with this abuse, which, in my opinion, is greater than the abuse of friendly societies ever was.

Yours, etc.,

MEDICAL STAFF No. II.

Sir: The letter on paying hospitals by "Medical Staff" in your issue of June 26 calls attention to a very serious condition of affairs at our charity hospitals. Many hospital patients have openly admitted that they could pay ordinary medical fees to junior specialists and general practitioners, but preferring the services of a senior man and not desiring or being in a position to pay his usually large fees, have attached themselves to his department at a public hospital and been admitted to one of his beds. This condition of affairs is obviously a grave injustice to all immediately concerned, namely, the senior specialist who is favoured, the junior specialist or general practitioner who would be glad of the fees the patient could pay, and, last but not least, the unfortunate poor who cannot pay any fees at all and who are often "squeezed out" by people who should never be admitted to a public hospital. The honorary medical staffs are being exploited by the management of hospitals, as can readily be ascertained by anyone who cares to take the trouble to inquire from patients the amount they contribute, for the class of patient complained of are generally encouraged to attend the public hospital, but would indignantly resent the suggestion that they were receiving charity. It is time something was done and one hopefully looks to the British Medical Association to move in the matter.

Yours, etc.,

MEDICINUS.

Melbourne,
July 2, 1920.

SYPHILITIC INFECTION FROM BOXING GLOVE.

Sir: The following case may be of interest in view of the unusual mode of infection.

A naval rating was admitted to the R.A.N. Venereal Hospital, Garden Island, suffering from secondary syphilis.

Whilst away from Australia he had been matched against a coloured man in a shore boxing tournament. During the bout the sailor drew blood from his opponent's face, which the latter wiped with his own gloved hand. In a subsequent round the coloured man delivered a punch to the sailor's bare chest, causing a skin abrasion over the left third costo-chrondal articulation, at which site subsequently developed a sore, with secondary signs of syphilis and a positive Wassermann blood test in due course.

The sailor had not had syphilis before and, being judged a credible man, his statement that he had not exposed himself to infection in any other way was accepted. On examination there was no sign of another primary focus. The virus may have been contained in dried blood on the gloves (if used previously) or in the drawn blood of his opponent soiling the gloves when the latter wiped his face.

Sterilization of gloves before a fight would therefore not be of much value.

With a view to the prevention of a like misfortune, it would be wise for a boxer to smear himself with calomel ointment before entering the ring.

Yours, etc.,

KEVIN BYRNE,
M.B., Ch.M.

Lakemba, New South Wales,
July 2, 1920.

Proceedings of the Australian Medical Boards.

SOUTH AUSTRALIA.

The undermentioned have been registered, under the provisions of the *Medical Act, 1880*, as duly qualified medical practitioners:—

Wilfrid Hallow William Condell Carden, L.R.C.P. and L.M., Irel., 1914; F.R.C.S., Irel., 1919.

William Carrick Tunk Upton, M.D., Ch.M., Sydney, 1919.

Medical Appointments.

The appointment of the Honourable J. B. Nash, M.D. (B.M.A.), and of Dr. H. J. Wolverton Brennand (B.M.A.) as members of the Medical Board of New South Wales, in place of the late Sir Phillip Sydney Jones and Dr. C. S. Willis, is announced in the *New South Wales Government Gazette*.

Dr. W. A. H. Birrell (B.M.A.) has been appointed Public Vaccinator at Nathalia and Dr. Ellen C. Edgerton (B.M.A.) at Woods' Point, Victoria.

The appointment of Dr. H. F. Elvins (B.M.A.) by the Shire of Bannockburn as its Medical Officer of Health, has been approved by the Commission of Public Health of Victoria.

Dr. Clive Shields (B.M.A.) has been appointed Medical Officer of Health for the Malmsbury Riding of the Shire of Kyneton, Victoria.

It is announced that Dr. A. B. Russell (B.M.A.) has been appointed District Medical Officer and Public Vaccintor at Jarrahdale, Western Australia.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, locum tenentes sought, etc., see "Advertiser," page xxv.

The Australian Institute of Tropical Medicine: Director.

Medical Appointments.

IMPORTANT NOTICE.

Medical practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, 429 Strand, London, W.C.

Branch.	APPOINTMENTS.
VICTORIA. (Hon. Sec., Medical Society Hall, East Melbourne.)	All Friendly Society Lodges (other than the Grand United Order of Oddfellows and the Melbourne Tramways Mutual Benefit Society), Institutes, Medical Dispensaries and other Contract Practice. Australian Prudential Association Proprietary, Limited. Mutual National Provident Club. National Provident Association.
QUEENSLAND. (Hon. Sec., B.M.A. Building, Adelaide Street, Brisbane.)	Australian Natives' Association. Brisbane United Friendly Society Institute. Cloncurry Hospital. Stannary Hills Hospital.
SOUTH AUSTRALIA. (Hon. Sec., 3 North Terrace, Adelaide.)	Contract Practice Appointments at Renmark. Contract Practice Appointments in South Australia.
WESTERN AUSTRALIA. (Hon. Sec., 6 Bank of New South Wales Chambers, St. George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW SOUTH WALES. (Hon. Sec., 30.-34 Elizabeth Street, Sydney.)	Australian Natives' Association. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham Dispensary. Manchester Unity Oddfellows' Medical Institute, Elizabeth Street, Sydney. Marrickville United Friendly Societies' Dispensary. North Sydney United Friendly Societies. People's Prudential Benefit Society. Phœnix Mutual Provident Society.
NEW ZEALAND: WELLINGTON DIVISION. (Hon. Sec., Wellington.)	Friendly Society Lodges, Wellington, New Zealand.

Diary for the Month.

July 13.—N.S.W. Branch, B.M.A., Ethics Committee.
July 13.—Tas. Branch, B.M.A..
July 15.—Vic. Branch, B.M.A., Council.
July 16.—Eastern Suburbs Med. Assoc. (N.S.W.).
July 17.—Northern Suburbs Med. Assoc. (N.S.W.).
July 20.—N.S.W. Branch, B.M.A., Executive and Finance Committee.
July 21.—W. Aust. Branch, B.M.A..
July 22.—Q. Branch, B.M.A., Council.
July 27.—N.S.W. Branch, B.M.A., Medical Politics Committee; Organization and Science Committee.
July 28.—Vic. Branch, B.M.A., Council.
July 29.—S. Aust. Branch, B.M.A..
July 30.—N.S.W. Branch, B.M.A..
Aug. 4.—Vic. Branch, B.M.A..
Aug. 9.—N.S.W. Branch, B.M.A., Ethics Committee.
Aug. 10.—Tas. Branch, B.M.A..

EDITORIAL NOTICES.

Manuscripts forwarded to the office of this journal cannot under any circumstances be returned.

Original articles forwarded for publication are understood to be offered to *The Medical Journal of Australia* alone, unless the contrary be stated.

All communications should be addressed to "The Editor," *The Medical Journal of Australia*, B.M.A. Building, 30-34 Elizabeth Street, Sydney. (Telephone: City 2645.)

We are seeking copies of our issues of February 14 and 28, 1920. There has been an unusual demand on our stock, which is now depleted. Members who do not keep *The Medical Journal of Australia* for binding, are requested to send us their copies, on receipt of which the usual payment of the face value will be made.